MEMOIR No. 34

AN ACCOUNT OF THE PLANT ECOLOGY OF THE CATHEDRAL PEAK AREA OF THE NATAL DRAKENSBERG

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FRONTISPIECE.—Prominent peaks in the Cathedral Peak area lying forward of the general line of the scarp. In the foreground is the Camel, at left middle distance are the Pyramid and Column and in the background are the Mitre, Chessmen, Inner and Outer Horns, Bell and Cathedral Peak. Note the stratification of the basalt accentuated by the fall of snow.

REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF AGRICULTURAL TECHNICAL SERVICES

BOTANICAL RESEARCH INSTITUTE

BOTANICAL SURVEY MEMOIR No. 34

AN ACCOUNT OF THE PLANT ECOLOGY OF THE CATHEDRAL PEAK AREA OF THE NATAL DRAKENSBERG

(With map, 10 figures and 49 plates, being a thesis submitted in partial fulfilment of the requirements for the degree of Ph.D. in the Department of Botany, University of Natal)

BY

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1963

PRINTED IN THE REPUBLIC OF SOUTH AFRICA BY THE GOVERNMENT PRINTER, PRETORIA

G.P.-S.3063027—1962-63—1,000.

FOREWORD

The economic use of water resources is important in any country. In a country such as South Africa, of which at least two-thirds of the area may be classified as arid or semi arid, the need for conserving water is all the more important. Sound conservation methods require a foundation of basic research. Opinions have been expressed freely in South Africa as to the relative value of indigenous and exotic vegetation in the utilization of rainfall. The opinions were personal with no factual evidence to support them. For this reason the Department of Forestry decided to investigate the effects of afforestation on water supplies on the slopes of the Drakensberg in Natal. A site, now known as the Cathedral Peak Forest Influences Research Station, was selected.

As a preliminary to afforestation, Mr. D. J. B. Killick, of the Division of Botany, was detailed to undertake a basic botanical survey of the research area. Subsequently the scope of the survey was enlarged to include the surrounding areas. Mr. Killick had already proved his ability to undertake such an exacting task by the successful completion of an account of the plant ecology on the Table Mountain in Natal. The results of this project were published in 1959, as No. 32 of the series of memoirs of the Botanical Survey of South Africa. This latter was prepared under the guidance of Professor A. W. Bayer, a member of the Botanical Survey Advisory Committee and Mr. Killick was fortunate in again having Professor Bayer's guidance in his work in the Cathedral Peak area. Mr. Killick is to be congratulated on the award of the Ph.D. degree by the University of Natal in recognition of the outstanding merit of his thesis.

One of the several important facts brought out in the text is the relatively small area which may be regarded as colonized by climax vegetation. The rigorous environment produces first one factor and then another to disturb the smooth course of ecological evolution. It is a state which has existed over many millions of years and will exist for many more. The result is a number of complex habitats and a persistently rich flora. At the higher altitudes the affinity of the flora with that of the south western Cape and with that on the mountains of tropical Africa becomes more and more evident. This is not a new observation but more specific examples of the relationship have been recorded for the first time.

The text has been slightly reduced in length for publication and the number of illustrations has also been curtailed in an effort to reduce the cost of reproduction and in so doing to keep the price as low as possible. This account of the flora of an extremely beautiful part of the country will appeal to all those with a biological interest as well as to all visitors to the area.

R. A. DYER,
Chief: Botanical Research Institute, and
Director of Botanical Survey

Pretoria
May, 1962

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INTRODUCTION

Early in 1950 the Division of Botany, Pretoria, was approached by the Department of Forestry to carry out a botanical survey of the research area at Cathedral Peak Forest Influences Research Station. I was assigned to the project and commenced work in September of the same year. The Cathedral Peak Forest Influences Research Station is situated about 26 miles (42 Km) south-west of Winterton in the Bergville district of Natal on latitude 29° 00′ S and longitude 29° 15′ E.

At Cathedral Peak the Forestry Department is investigating the effects of afforestation (chiefly with *Pinus patula*) on water supplies, and is comparing them with the effects of controlled burning, with and without grazing, and of complete protection of the natural vegetation.

The research area is situated on the Little Berg below the Drakensberg escarpment and occupies an area of 1851 acres (749 Ha). It consists of 10 catchments lying on either side of a long spur projecting from the escarpment. The method of investigation is briefly as follows. Streamflow in each of the catchments is measured continuously for varying lengths of time while the catchments are under natural vegetation. Then the treatment is applied and subsequent differences in streamflow are evaluated with due regard to climatic variations within the experimental period.

The botanical survey involved the following:—

(1) The preparation of a vegetation map of the research area.

(2) Detailed vegetation maps and analyses of Catchments 1 and 9, to be repeated at intervals afterwards. Catchment 1 is being burnt and grazed, while Catchment 9 is being totally protected.

(3) A study of the plant succession.

On completion of the survey in 1952, the Division of Botany felt that, because of the lack of detailed knowledge of the vegetation of the Drakensberg, it was desirable to enlarge the scope of the survey to include the area above and below the Little Berg. The enlarged area represents the whole of the Cathedral Peak area between 4,200– c. 11,000 ft (1,280– c. 3,353 m) and is shown on the appended map, which is based very largely on the map produced by Mr. R. O. Pearse for the Cathedral Peak Hotel. This work is an account of the plant ecology of the Cathedral Peak area.

For purposes of comparison, visits were made to the Sani Pass, Giants Castle and Cathkin Peak areas, and to the summit area between Cathedral Peak and Mont aux Sources.

It was not possible to produce a vegetation map of the Cathedral Peak area, because of the lack of a large-scale contour map of the area.

The vascular plants mentioned in the text were named at the National Herbarium, Pretoria, and many of the determinations were checked by me at Kew. Thirty new species were discovered during the course of the survey of which 25 have been described in Bothalia and elsewhere. Numbers given after plant names are my collecting numbers.

All the photographs were taken by me with the exception of Plate 14, which is a composite photograph taken of portions of aerial photographs 3,183 and 3,185 (Trigonometrical Survey Office, Strip 30).

I am indebted to Professor A. W. Bayer of the Botany Department, University of Natal, for helpful advice and criticism. I am grateful to Dr. R. A. Dyer, Chief of the Division of Botany, for providing me with such an interesting subject for research and thereby continuing my interest in mountain ecology. Thanks are also due to Mr. A. M. de Villiers and Mr. U. W. Nänni, past and present Forest Research Officers at Cathedral Peak respectively, for their co-operation and interest in my work, and to the late Dr. D. McK. Malcolm for kindly checking the spelling of the Zulu names in Chapter 9. Finally, I must thank the Department of Agricultural Technical Services for permission to use an official project as the subject for a thesis.

CHAPTER 1

TOPOGRAPHY, GEOLOGY AND SOILS

1.1. TOPOGRAPHY

The Drakensberg Range forms part of the Great Escarpment at the eastern edge of the interior plateau of Southern Africa. It extends from the Eastern Cape to the Northern Transvaal, a distance of over 600 miles (968 Km). In the south the Drakensberg forms the boundary between the Cape Province and Basutoland, then between Natal and Basutoland and finally between Natal and the Orange Free State before it passes into the Transvaal. It derives its name from a peak 30 miles (48 Km) west of Matatiele called Drakensberg or Dragon's Rock (Wellington, 1955, p. 39). In early literature the Drakensberg is sometimes referred to by its Zulu name, uKhahlamba, meaning " a row of up-pointing spears " (Doke, Malcolm & Sikakana, 1958, p. 127).

The structure of the Natal Drakensberg between Xalanga Peak in the south and Mont aux Sources in the north, is remarkably homogeneous and the scenery repeats itself over and over again. According to King (1944, p. 261) this " unity of expression results from a single cycle of erosion and a uniform solid geology throughout the length of the High Berg ". The name High Berg is given to the Natal Drakensberg south of Mont aux Sources, to distinguish it from its northern extension where it drops in height as a result of the loss of its lava cover of basalt.

The Drakensberg consists of a continuous scarp or mountain wall, abrupt and rugged, varying in height from foot to crest about 2,500–7,000 ft (762–2,134 m). The highest point on the summit was recently established to be Thabana-Ntlenyana, the Pretty Mountain, 11,425 ft (3,484 m), about 15 miles (24·2 Km) south-west of Giants Castle. Highest points in the Cathedral Peak area are Cleft Peak, 10,700 ft (3,262 m) and Indumeni Dome 10,580 ft (3,225 m). The basalt expresses itself in a variety of structures—buttresses, attached or otherwise, pinnacles, sometimes delicate and fluted, towers and so on. Several prominent peaks in the Cathedral Peak area are situated forward of the general line of the scarp. These include Cathedral Peak itself, 9,856 ft (3,004 m), with the Inner and Outer Horns on the same spur, 9,898 and 9,873 ft (3,018 and 3,009 m) respectively and the Pyramid, 9,276 ft (2,828 m). See Frontispiece and Plate 1. An excellent example of pinnacle structure is to be seen in the pinnacles constituting the Organ Pipes.

Below the main Drakensberg escarpment is a terrace consisting of finger-like spurs projecting into Natal more or less at right angles to the escarpment and known as the Little Berg (Plate 2). Capped with basalt, this terrace lies between 6,000–8,000 ft (1,829–2,439 m), and the spurs end in conspicuous Cave Sandstone cliffs.

Rivers on the Little Berg in the Cathedral Peak area, namely the Oqalweni, Xeni, Tseketseke, Umhlonhlo, Indumeni, Masongwaan and Mhlwazeni, have incised their courses to produce very deep valleys which open out into the comparatively wide and shallow valley or flood-plain of the Mlambonja River, a tributary of the Tugela River. The lowest point of the Mlambonja Valley is about 4,100 ft (1,250 m).

From the foregoing it will be realized that there are three main terraces in the Drakensberg viz. the summit plateau of the Drakensberg, the Little Berg and the river valleys. It will be shown later that the three vegetation belts of the Drakensberg correspond with these terraces.

1.2. Geology

The geology of the Drakensberg is simple, because the rocks lie more or less horizontally. The formations belong to two series of the Karoo System, namely the Stormberg and Beaufort Series. In descending order the formations are:—

Stormberg Series

Basaltic Lavas (Drakensberg or Volcanic Beds)
Cave Sandstone
Red Beds
Molteno Beds

Beaufort Series

Upper Beaufort Series (Burghersdorp Series)

(i) *Basaltic Lavas.*—This formation, the youngest of the Karoo System, has a vertical thickness of nearly 5,000 ft (1,524 m). The lava flows are evenly superposed one on the other and, according to King (1944, p. 258), vary in thickness from a few inches to 150 ft (46 m). The basalt is conspicuously stratified (see Frontispiece). The lower slopes are grassed and fairly flat; higher up they are very steep and form buttresses to the cliffs of the main escarpment. The cliffs are dark-coloured, bare and in the Cathedral Peak area sometimes sheer for 1,500 ft (457 m). Finally on the summit are rounded slopes and small escarpments at the eroded edges of the more resistant flows.

(ii) *Cave Sandstone.*—This is a massive formation about 300 ft (91 m) thick, consisting of fine-grained rock. It is very conspicuous in the cream-coloured cliffs bounding the Little Berg between 5,500–5,900 ft (1,677–1,799 m). Frequently the cliffs are undercut at the base to form caves or more strictly overhangs, where Bushmen paintings are to be found. The formation dips in a westerly direction.

(iii) *Red Beds.*—These beds form the steep grassy slopes below the Cave Sandstone cliffs of the Little Berg. They are made up of red and purple mudstones and shales and fine-grained felspathic sandstone. The rock is rarely exposed.

(iv) *Molteno Beds.*—This formation forms ledges or terraces at the foot of the Little Berg and comprises several bands of coarse sandstone interleaved with shales typically grey and blue in colour.

(v) *Upper Beaufort Beds.*—These beds cover the rolling country in front of the High Berg. In the Cathedral Peak area rocks of this formation are to be found at the bottom of the river valleys. The beds consist of fine to medium-grained felspathic sandstones, mudstones and shales.

1.3. Soils

1.3.1. *Summit Area*

The soils of the summit of the Drakensberg (and the Little Berg) are classified as Mountain Black Clays (van der Merwe, 1941, pp. 117–125). They are of residual and colluvial origin and are derived entirely from basalt.

No soil analyses have been carried out in the Cathedral Peak area, but Venter (Staples & Hudson, 1938, pp. 10–11) has studied the summit soils further north near Mont aux Sources. He describes the soils as turfy and varying in colour from brown through chocolate brown to black, depending upon the amount of leaching and oxidation. The soils are thin and never exceed 18 in (45·7 cm) in depth. Venter found that there were differences in the soils of southern and northern aspects: slopes with a southern aspect are blacker in colour and contain a higher percentage of moisture, K_2O, P_2O_5 and humus.

During summer the soils of the summit become boggy, while during winter months they very often freeze. Common on the summit are what Schelpe (1946, p. 80) has called "mud-patches". They consist of moist, almost bare patches of soil, which are subject to frost action. On thawing, the soil in these patches exhibits a peculiar raked appearance or as described by Venter (p. 54), "it resembles a soil in which a small burrowing animal was searching for food". Troll (1944, pp. 583–588) made a detailed study of frost action on the summit of the Drakensberg. He attributed the raked effect of the soil surface to wind.

1.3.2. *Little Berg*

The soils of the Little Berg and Mlambonja Valley have been the subject of a special investigation by Van der Merwe (1955 and 1956). The purpose of the investigation was to determine whether there were edaphic reasons for the poor growth of *Pinus patula* on the Little Berg as compared with the Mlambonja Valley. The following account is based very largely on Van der Merwe's work.

The Little Berg soils are deep and horizons are ill-defined. Analytical results are given in Table 1 (part i).

The surface soil ranges in thickness from 7–12 in (17·8–30·5 cm) and consists of a dark brown to blackish brown, granular to crumbly clay-loam and clay permeated by grass roots. Organic content, as indicated by ignition loss, is high: it varies from 27 per cent on the steep slopes at the top of the higher catchments to nearly 50 per cent on the flatter areas at the base of the catchments (Nänni, 1956, p. 10). As pointed out by Nänni the high organic content is surprising considering that the area is subject to regular burning.

Next is a layer varying from 18–48 in (45·7–120 cm) and more in depth. It consists of granular brown clay loam to clay, dense and compact when moist, but badly cracked when dry. Grass roots and rock fragments are present. Then there is a stony loam with angular stones predominating and finally partly and slightly decomposed basalt. Soil reaction varies from pH 5·6 to 6·6.

Exchangeable base and total adsorbed base values are high. With the exception of potassium, higher cation values are to be found in the subsoil than in the surface soil.

Clay mineral tests (Table 2, part i) revealed the presence of weak montmorillonite between 13–18 in (33–71·1 cm) and definite at all layers below this. Montmorillonite is a feature of many mountain soils. It has a fairly high exchange base content and gives to the soil certain unfavourable

TABLE 1.—Analytical Results (Van der Merwe, 1956)

Sample No.	Depth		pH	Resistance 60°F (15·6°C)	Exchangeable Bases				Total adsorbed bases
	in	cm			Na m.e./100 gr	K m.e./100 gr	Ca m.e./100 gr	Mg m.e./100 gr	
(i) Little Berg									
B6062	0–7	0–18	6·0	4,500	0·28	0·38	5·40	4·44	14·30
B6063	7–13	18–33	5·6	10,000	0·24	0·21	1·48	1·32	9·60
B6064	13–28	33–71	6·1	5,100	0·50	0·19	8·52	9·12	21·30
B6065	28–64	71–163	6·2	1,540	0·34	0·23	18·53	17·39	33·50
B6066	64–90	163–229	6·5	1,920	0·44	0·34	17·95	11·15	30·60
B6078	66–102	168–259	6·6	4,020	0·42	0·23	17·78	8·12	26·40
(ii) Mlambonja Valley									
B6150	0–10	0–25	5·0	5,000	0·30	0·33	1·14	1·21	7·96
B6151	10–24	25–61	5·1	10,000	0·30	0·16	0·49	0·61	5·24
B6152	24–39	61–99	5·2	10,000	0·26	0·16	0·49	0·53	5·20
B6153	39–66	99–168	5·1	10,000	0·28	0·20	0·37	0·92	7·92

TABLE 2.—Clay Minerals (Van der Merwe, 1956)

Sample No.	Clay Mineral Composition		
	Definite	Weak	Doubtful
		(i) Little Berg	
B6062	—	—	Soil kaolin, montmorillonite
B6063	No clay minerals	—	—
B6064	—	Montmorillonite	—
B6065	Montmorillonite	—	—
B6066	Montmorillonite	Soil kaolin	—
B6078	Montmorillonite	—	—
		(ii) Mlambonja Valley	
B6150	No clay minerals	—	—
B6151	Montmorillonite	Soil kaolin	—
B6152	—	Soil kaolin, illite, montmorillonite	—
B6153	Soil kaolin, illite	Montmorillonite	—

morphological characteristics, namely expansion on wetting and the production of wide fissures on drying—characteristics which adversely affect soil aeration, water penetration and can cause mechanical injury to plant roots.

1.3.3. *Mlambonja Valley*

Samples were taken near a plantation of *Pinus patula* situated at about 4,500 ft (1,372 m) just below the Cave Sandstone cliffs. Results are given in Table 1 (part ii).

The surface soil is 10 in (25·4 cm) thick and consists of a brown, granular clay, penetrated by grass roots. Next is a layer 14 in (35·6 cm) thick of reddish yellow, crumbly to friable clay. Underlying this is 15 in (38·1 cm) of yellowish red, crumbly, slightly dense clay resting on a foundation of reddish brown, crumbly, fairly dense clay 18 in (45·7 cm) thick and deeper.

Exchangeable base and total adsorbed base values are low and the highest cation values are to be found in the surface soil. Soil reaction varies from pH 5·0 in the surface soil to 5·2 at lower levels.

Montmorillonite is definite only between 10–24 in (25·4–61 cm). Deeper it is weak (Table 2, part ii).

This soil is morphologically closely related to the Lateritic Red Earths of the Mistbelt.

Comparison of soils of the Little Berg with those of the Mlambonja Valley

From Table 1 it is evident that the soils have been leached of their soluble salts as is indicated by the high values obtained for electrical resistance. Soil reaction on the Little Berg is slightly acid as against acid in the Mlambonja Valley soil. The exchangeable bases and total adsorbed bases of the basalt soil are much higher than those of the Mlambonja Valley soil. Both soils contain montmorillonite, but it is mostly weak in the soils of the Mlambonja Valley. From the above it is clear that, from a plant nutrient point of view, the soil of the Little Berg is more fertile than that of the Mlambonja Valley, but is inferior physically.

Since both soils contain montmorillonite, why is the growth of *Pinus patula* not hindered in the Mlambonja Valley? Van der Merwe (1956, p. 5) believes that the reason is that the soils of the Mlambonja Valley contain adventitious material in the form of ferric oxides and hydroxides which reduce the expanding and contracting characteristics of the montmorillonite clay mineral to a minimum.

If the growth of exotics on the Little Berg is adversely affected by the montmorillonite soils, then it is reasonable to assume that indigenous trees are similarly affected. According to Van der Merwe (l.c. p. 1) indigenous trees do not normally occur on montmorillonite black clay soils. Examples are the Springbok Flats and the Rustenburg region of the Transvaal. It is clear then, that this soil factor must be considered when trying to account for the paucity of natural tree growth on the Little Berg. The question will be discussed on p. 83.

Terracettes

A peculiar feature of the grass slopes above the Cave Sandstone cliffs is the presence of horizontally arranged crescentic scars, which King (1944, p. 258) has called terracettes (Plate 3)—a name which is now in common local use. The choice of this name is unfortunate: it was originally coined by Odum (quoted by Sharpe, 1938, p. 70) to describe the so-called sheep or cattle terraces which are caused by slumping. Unlike the Drakensberg terracettes, these terracettes are more or less continuous and not scattered.

The terracettes in the Drakensberg range up to 20 ft (6 m) long, 3 ft (91 cm) wide and 1–2 ft (30·5–61 cm) high. Occasionally they attain a length of 54 ft (16 m) probably as a result of the fusion of two or more terracettes.

Several theories have been put forward to account for their formation. According to King (1942, p. 14) they result from the downward slip of soil, which has become excessively lubricated by thawing snow i.e. a form of solifluction. This theory is untenable for the reason that terracettes can occur at altitudes very rarely subject to falls of snow, for example the major portion of the Little Berg.

Troll (1944, pp. 588–590) visited the Mont aux Sources region of the Drakensberg in 1934 and noticed the presence of terracettes on grass slopes between 6,000–7,500 ft (1,829–2,286 m). He found the terracettes only on shaded slopes, which he described as having a soil saturated with water, rich in humus and lying over rock to a depth of 3 ft 3 in (1 m). In contrast, the sunny slopes are smooth and support a " steppe " soil which is grey, dry and 1 ft (30 cm) deep over rock. Troll suggested two possible causes for terracette formation: (i) water saturation of the soil, or (ii) frost action. It is clear, however, that he favoured the latter theory, for he states " mochte ich glauben dass das Eis stark im Spiele ist, und dass es sich um eine Art Solifluction handelt ". Water saturation seems an unlikely cause, because terracettes (contrary to Troll's observations) though commoner on mesic slopes also occur on xeric slopes where water-logging of the soil is unlikely to occur. Observations made by the present author support Troll's frost action theory.

Schelpe (1946, p. 6) states that terracettes " probably result from soil creep in their initial stages, but it has been observed that frost erosion contributes greatly to their enlargement ". Schelpe does not explain what he means by soil creep. According to Sharpe's classification (1938, pp. 46–48) of soil and rock movement, frost erosion itself is a form of soil creep.

West (1951, p. 13) noticed the occurrence of terracettes in the Cathkin–Giants Castle area and suggested that they were caused by soil slip over underlying rock. This theory is untenable, because rock is not always evident below terracettes. The absence of rock can be seen where forestry roads cut through terracettes.

Nänni (1956, p. 12) favours an explanation put forward by Hallsworth, Robertson & Gibbons (1955) working in Australia. According to these workers soil movement takes place because the active clay of the upper horizons, which rests on a base of weathered rock, " shows a characteristic swelling capacity which is increased considerably in the subsoil ". This property of the clay is said to produce small undulations of the landscape

called " gilgai ". These structures, however, are quite different from the terracettes of the Drakensberg and are characteristic of warmer and usually drier regions.

As already indicated the author agrees with Troll and Schelpe that frost action plays a major part in the formation of terracettes. Before describing the process, it is desirable to examine the structure of steep grass slopes. After a grass burn the structure is clearly revealed. The slopes are by no means smooth—rather they consist of a complicated system of miniature terraces or ledges (resembling the terracettes of Odum) on which the grass tussocks are situated (Plate 4). These terraces are apparently caused by surface wash or sheet erosion. After a heavy storm water rushes down the slopes removing soil and depositing it behind the tussocks. This process of erosion and deposition continues and eventually sufficient soil accumulates to form a low terrace.

In parts the terraces are subjected to erosion by frost action. The mechanics of frost action have been investigated by Taber (1929, 1930). Briefly the process is as follows. At night during winter when the air temperature is at freezing point, but the soil is above freezing point, water segregates just below the surface of the soil and freezes. Vertically orientated frost crystals (synonyms: needle ice, spew frost, kammeis, pipkrake) are formed and grow downwards by drawing up water through the soil capillaries by molecular cohesion. The growth of frost crystals results in the uplift of the soil sometimes by as much as 4 in (10·2 cm). See Plate 5.

On thawing the bases of the crystals melt first with the result that the soil particles fall some distance away from their original position. The process of alternate freezing and thawing continues right through winter and more and more soil is removed until a crescentic terracette is formed. At the end of each winter the floors of the terracettes are covered with a loose and powdery soil which can be blown by strong westerly winds or washed away by the first storms of spring. It has been noticed that frost crystals do not form near the top edge of terracettes presumably because the upper surface of the soil is comparatively dry. The result is that the top edge projects beyond the wall and, being anchored by the surface roots of grasses, persists for some time. Frost crystal formation is illustrated in Fig. 1.

Why a terracette should develop in any one spot is difficult to explain. According to Taber (1930, pp. 306–307) frost action is dependent upon a fine soil texture, high water content of the soil and a sparse plant cover. Soil texture is fairly uniform on the Little Berg, consequently very local accentuation of the other two factors may be responsible.

Several other observations have been made. The best examples of frost action are to be found along bridle paths, especially where they contour moist gullies. Very often during summer portions of the walls of the terracettes come away in large slabs. This may be due to the clay mineral content of the subsoil discussed on p. 5.

Ecologically frost action is important. Firstly, through uplift of the soil it can cause considerable damage to plants, and secondly it produces bare areas on which succession is initiated. The vegetation of terracettes will be described on pp. 70 and 73.

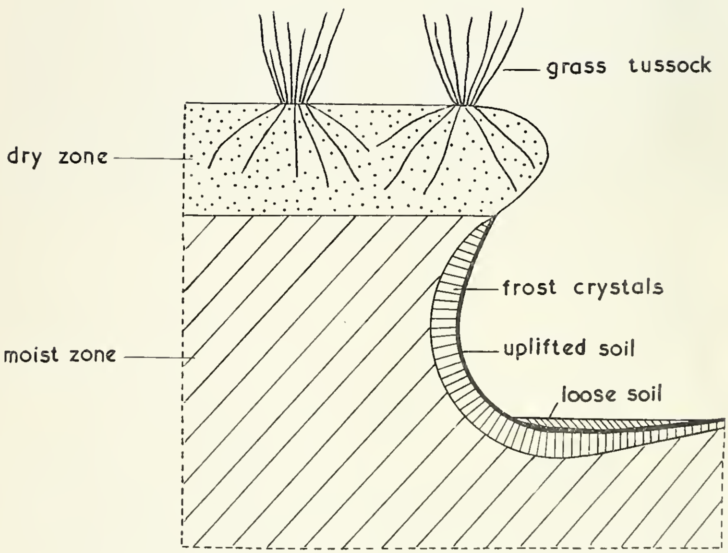

FIG. 1.—Diagrammatic representation of frost crystal formation in a terracette

Chapter 2

CLIMATE

2.1. Insolation

Intensity and amount of insolation are not measured at Cathedral Peak, but records are available for duration of sunshine, an important aspect of insolation. Duration of sunshine is measured at the Forestry Department meteorological station at 6,100 ft (1,817 m) on the Little Berg. Data for the period 1950–1958 are given in the form of curves in Fig. 2. Average daily sunshine varies between 5·5 hours during the wet summer month of December and 8·3 hours during the dry winter month of June, i.e. 39 and 82 per cent respectively of the possible sunshine. According to Nänni (1956, p. 19) the mountains to the west and north-west reduce the available sunshine by amounts varying from 10 per cent during December to 1 per cent during June. This loss becomes greater the nearer the main escarpment is approached.

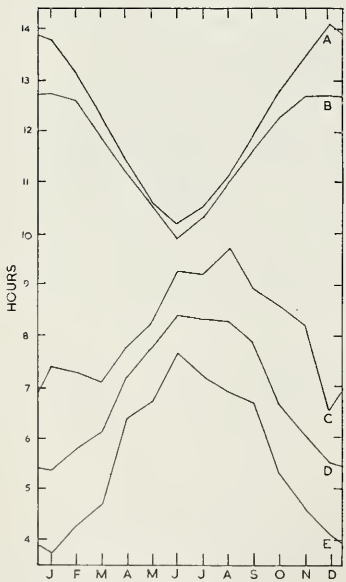

Fig. 2.—Daily sunshine at Cathedral Peak (9 years)

A. Theoretical possible
B. Absolute monthly maxima
C. Highest monthly means
D. Mean monthly means
E. Lowest monthly means

2.2. Temperature

The only temperature stations in the Natal Drakensberg are at Cathkin Park and Cathedral Peak. The station at Cathkin Park is situated at 4,192 ft (1,278 m) about 10 miles (16 Km) south of Cathedral Peak in a

river valley at the foot of the Little Berg, while the one at Cathedral Peak is situated at 6,100 ft (1,860 m) on the Little Berg. The temperature records have been used to produce the two Deasy (1941) charts in Fig. 3.

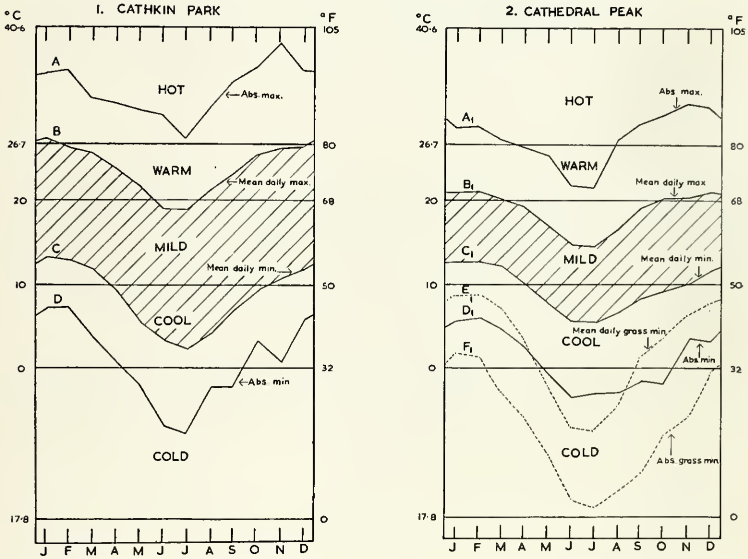

FIG. 3.—Temperature charts for Cathkin Park (11 years) and Cathedral Peak (air temperature, 10 years; grass temperature, 6 years)

The curves for mean diurnal fluctuation, B and C, B_1 and C_1, show that air temperature at Cathkin Park is cool–mild–warm and that at Cathedral Peak is cool–mild. Only in the absolute values represented by curves A and D, A_1 and D_1, does the temperature reach degrees of hot and cold. From an ecological point of view it is the absolute values which are significant.

The highest temperature recorded at Cathkin Park is 102·02°F (38·9°C) in November 1937 and the lowest 17·96°F (—7·8°C) in July 1945. At Cathedral Peak the highest temperature recorded is 88·2°F (31·2°C) in November 1951 and the lowest 25·5°F (—3·6°C) in June 1953. At both stations frosts are almost a daily occurrence in winter.

It is well known that in mountain climates diurnal range of temperature decreases with increase in altitude. The available temperature records illustrate this phenomenon. Comparing the two charts in Fig. 3 it will be seen that the values for absolute maximum and mean daily maximum are lower at Cathedral Peak than at Cathkin Park, but the values for absolute minimum and mean daily minimum are higher i.e. $A_1 < A$, $B_1 < B$, $C_1 > C$, $D_1 > D$. Diurnal temperature range is therefore narrower at Cathedral Peak, the higher situated station. The lower minima at Cathkin Park may seem anomalous in view of the fact that air temperature decreases with increase of altitude. However, the lower minima can be explained

by temperature inversion. On calm nights, which are especially frequent in winter, cold air drains into the main river valleys and leaves the mountains comparatively warm.

It will be noticed that the Deasy chart for Cathedral Peak includes two broken curves E_1 and F_1 for grass minimum temperature. It was felt that the temperatures recorded in the Stevenson Screen 4 ft (1·2 m) above ground were hardly indicative of the temperatures obtaining at ground or grass level and, since grassland covers most of the Little Berg, it was decided to record temperature at grass level as well.

The results are quite striking. The values for mean daily minimum E_1 [below 50°F (10°C) throughout the year] and absolute minimum F_1 [below 32°F (0°C)] at grass level are consistently lower than the corresponding values recorded in the Stevenson Screen. On the night of 27 June, 1959, the minimum temperature in the Stevenson Screen was 51·8°F (11·0°C) and at grass level 5·72°F (—14·6°C) giving a difference of 46·08°F (25·6°C). The lowest value recorded by the grass minimum thermometer is 2·3°F (—16·5°C) in July, 1954.

The cause of the low temperatures at grass level is the loss of heat by radiation at night. Radiation is especially active when the nights are calm and the sky is clear, that is during the winter months. This is illustrated by a comparison of curves C_1 with E_1 and D_1 with F_1. The curves diverge most between May and September.

2.3. Winds

The chief surface winds over the interior of Natal have been described in " Weather on the Coasts of Southern Africa " (Anon., 1941, pp. 15–16). Between December and February the prevailing direction is east and south-east. These are the rainbearing winds. From March to May the frequency of east and south-east winds decreases and the frequency of westerly winds increases. In winter (June to August) the prevailing direction is westerly and the south-east winds decrease to less than half their summer frequency. From September to November south-east winds increase in frequency again, the west and north-west decrease and the frequency of calm falls below 20 per cent.

The " bergwinds " which blow from the west during late winter and spring often attain great velocity. Buildings on the Little Berg suffer considerably: roofs may be torn off and a very substantial concrete outbuilding was blown down in August, 1957. Native horsemen on the Little Berg are sometimes forced to dismount and lie flat on the ground clutching hold of grass tufts for safety. These winds, though not as hot and dry as at lower altitudes (they become heated by compression as they descend), are very important ecologically, because they are generally accompanied by periods of low humidity and they blow at a time when soil moisture is at its minimum.

The plantation of *Pinus patula* in Catchment 2 testifies to the injurious effect of westerly winds. Nearly all the trees are shorn on the windward side, most tend to lean in an easterly direction, while some have been blown down. Catchment 2 is bounded by spurs which are continuous except in the south-west corner where there is a gap through which winds blow. The trees below this gap show marked stunting. Nänni (MS.) reports that the root malformation of trees in Catchment 2 is partly due to wind.

Strong winds occasionally accompany thunderstorms, but they rarely last for any length of time.

Winds are also important because they are prevalent during the dry season when fire hazard is at a maximum. Once a berg fire starts and there is an attendant wind, it is very difficult to put out.

2.4. Precipitation

2.4.1. *Rainfall*

The Natal Drakensberg lies in the summer rainfall area of South Africa. Until the establishment of the Cathedral Peak Forest Station very little was known about rainfall in the Drakensberg. To-day there are 25 permanent rain-gauges on the station and records obtained so far show that the Drakensberg is one of the wettest parts of the summer rainfall area. Table 3 gives the rainfall statistics for seven stations in the Cathedral Peak area.

From Table 3 it will be seen that most of the rain falls during the summer months i.e. between October and March. The proportion is about 85 per cent. The wettest months are January, February and March and the driest June and July.

Cathedral Peak derives its rain mainly from oceanic air-streams entering from east coast highs. At the beginning of summer most of the rainfall appears to be orographic. Later the frequency of thunderstorms increases and this form of precipitation provides about 50 per cent of the total rainfall. Thunderstorms arise mainly in the west.

The mornings in summer are usually clear. Clouds begin accumulating about midday and storms, one or more, break on a high proportion of afternoons or evenings in summer. Thode's (1901, p. 14) description of the summit after a storm is very vivid: " splashing ankle-deep through water that has miraculously spurted from the spongy, treacherous ground under your feet, jumping across raging torrents which were not there before, passing noisy cataracts undreamt of a short while ago ". The clouds then disperse and the nights are clear.

The average number of days per month on which rain is recorded is given by Nänni (1956, p. 17) as follows:—

July 3; August 7; September 9; October 15; November 20; December 22; January 23; February 22; March 19; April 10; May 7, and June 3.

The highest rainfall recorded in one hour at the meteorological station on the Little Berg is 3·2 in (81 mm) in February, 1954 and the highest intensity recorded for periods of 2–5 minutes is about 11 in (280 mm) per hour (Nänni, l.c., p. 14). The greatest fall in 24 hours is 4 in (102 mm).

Important ecologically are periods of drought and high rainfall. Nänni (1956, p. 22) has calculated the frequency of drought periods in the Mlambonja Valley for the period 1934–1953. During the 20 years there were 13 droughts of more than 90 days duration, seven droughts of more than 150 days duration, while the longest dry spell on record was between 186 and 190 days duration. It should be mentioned that in this calculation Nänni ignored daily rains of less than 0·5 in (12·6 mm). The highest

TABLE 3.—Mean Monthly Rainfall

	F.D. Office, Mlambonja Valley		Cathedral Peak Hotel, Mlambonja Valley		F.D. Met. Station, Little Berg		F.D., IIBr., Little Berg		F.D., IIAW., Little Berg		Organ Pipes Pass Summit, Drakensberg		Mokhotlong, Basutoland	
Altitude	4,490 ft (1,369 m)		4,820 ft (1,469 m)		6,100 ft (1,871 m)		6,480 (ft 1,981 m)		7,500 ft (2,287 m)		9,600 ft (2,927 m)		(7,797 ft 2,377 m)	
Latitude	28°56′S.		28°57′S.		28°59′S.		29°0′S.		29°0′S.		29°1′S.		29°17′S.	
Longitude	29°14′E.		29°11′E.		29°14′E.		29°13′E.		29°13′E.		29°11′E.		29°05′E.	
Period in yrs	5		17		9		10		6		3		20	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
January	7·26	184	7·26	184	7·76	197	9·75	248	11·17	284	13·53	342	3·90	99
February	10·97	279	9·27	236	11·39	289	11·77	299	15·45	392	11·65	295	3·19	81
March	6·69	170	8·40	213	8·34	212	9·37	238	11·18	284	8·14	207	2·68	68
April	2·06	52	2·70	69	2·25	57	2·90	74	2·98	76	1·94	49	1·38	35
May	1·39	35	1·07	27	1·37	35	1·49	38	2·05	52	1·82	46	0·83	21
June	0·37	9	0·54	14	0·52	13	0·58	15	0·95	24	1·80	27	0·20	5
July	0·35	9	0·43	11	0·53	13	0·49	13	0·51	13	0·05	1	0·39	10
August	1·06	27	1·11	28	1·52	39	1·51	39	1·79	45	0·61	16	0·55	14
September	2·74	70	1·80	46	2·65	67	2·66	68	3·66	93	2·39	61	0·79	20
October	3·48	88	3·57	91	4·29	108	4·79	122	6·45	164	4·28	109	2·17	55
November	5·61	143	5·51	140	6·16	157	7·19	183	10·44	265	8·95	226	2·99	76
December	6·85	174	6·76	172	9·10	231	9·93	252	12·79	325	9·08	230	3·07	78
TOTAL	48·83	1,240	48·42	1,231	55·88	1,418	62·43	1,589	79·42	2,017	63·52	1,609	22·14	562

annual rainfall recorded at Cathedral Peak is 95·5 in (2,426 mm) during the hyetal year 1954–1955. This was recorded by rain-gauge IIAW at 7,500 ft (2,287 m) on the Little Berg.

The altitudinal rainfall pattern in the Cathedral Peak area is typical of that of high mountains. Fig. 4 illustrates schematically the variation of mean annual rainfall (calendar years) with altitude at six stations in the Cathedral Peak area, including one in Mokhotlong, Basutoland, 25 miles (40·2 Km) south-west of Cathedral Peak.

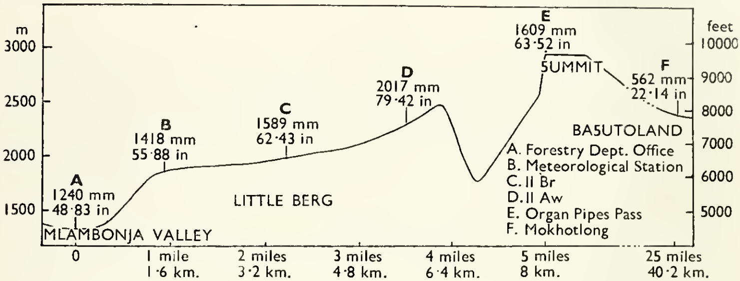

FIG. 4.—Profile through Cathedral Peak area showing variation of rainfall with altitude.

It will be seen that the rainfall increases from 48·83 in (1,240 mm) in the Mlambonja Valley to 55·88 in (1,418 mm), near the edge of the Litttle Berg, reaching a maximum of 79·42 in (2,017 mm) in the upper part of the Little Berg and decreasing to 63·52 in (1,609 mm) on the summit of the Drakensberg and 22·14 in (562 mm) at Mokhotlong.

The increase is due to the fact that elevations of land force air currents to rise and hence to cool. Furthermore, even when there are no general atmospheric movements, local ascending currents occur in mountain regions. The reason for the decrease in precipitation above a certain height is apparently because a vertical decrease of temperature also involves a decrease in the vapour content of the air.

At present there are no gauges between 7,500–9,600 ft (2,287–2,927 m). The zone of maximum precipitation may well lie somewhere between these altitudes.

The low rainfall of 22·14 in (562 mm) for Mokhotlong demonstrates very clearly the effectiveness of the scarps in creating a rain-shadow on the leeward side of the Drakensberg.

Lightning is important both geologically and ecologically. King (1944, p. 279) states that in Basutoland there are places where lightning has shattered bare rock into thousands of razor-sharp fragments. He suggests that some of the collapsed pinnacles in the Rockeries area of the Drakensberg may have been toppled by the violence of lightning discharge. In other words, lightning plays a part in landscape formation. When it strikes vegetation it can start fires which spread very rapidly if winds are favourable and the vegetation is reasonably dry. The part played by lightning-induced fires in the retarding of plant succession and the consequent predominance of grassland in the Drakensberg will be discussed on p. 36.

2.4.2. *Hail*

Hail rarely accompanies thunderstorms. According to Nänni (1956, p. 17) hail can be expected once in every two years, but for the Cathedral Peak area as a whole this is possibly an underestimation, because observations on the occurrence of hail are made only in the Mlambonja Valley. After a hailstorm the stones lie on the higher peaks sometimes for as long as two days. The largest stones seen by the writer measured 0·5 in (1·3 cm) in diameter. As an ecological factor, hail seems to be of little importance in the Drakensberg.

2.4.3. *Snow*

Snow can be expected any time between April and September. It occurs mainly in July. Brilliant sunshine soon follows falls of snow, so that it seldom lies for any length of time. However, in the winter of 1957, an exceptionally hard winter, the snow lay on the summit for two months. Usually snow is restricted to the summit and near-summit (Frontispiece) but occasionally it reaches 6,000 ft (1,829 m) and, according to Nänni (1956, p. 17) within living memory it has snowed heavily at 4,500 ft (1,372 m) only about three times. Old natives in the Cathedral Peak area still recall the Natal Blizzard of May, 1905, when the snow in the Mlambonja Valley was " knee-deep ".

Apart from increasing soil moisture during winter, snow acts as an insulating blanket protecting plants from excessively cold temperatures and preventing the ground beneath from freezing.

Mention should be made of an interesting phenomenon which can be observed on the summit during winter. After a fall of 6–12 in (153–305 mm) of snow the summit is covered with a seemingly continuous carpet of snow and the only plant evident is the 4 ft (1·2 m) tall *Euryops evansii*. On closer observation, however, numerous cavities can be seen in the snow. Visible through the cavities or projecting through them are plants (Plate 6) or sometimes stones. There is always a hollow space between the plant or stone and the snow, so that melting of the snow must take place from below as well as above. Schelpe (1946, p. 78) noticed this at Cathedral Peak, but Kihlman (Schimper, 1903, pp. 665–666) working in Russian Lapland was probably the first to suggest an explanation for this phenomenon. He suggested that plants and stones (presumably because they are dark-coloured objects) absorbed radiant energy from the sun through the snow in contact with them. A necessary condition for this is the previous, more or less complete, conversion of snow to névé, since snow itself is only slightly diathermic. Also, the snow cover must be thin enough to allow the sun's rays to penetrate. This phenomenon may have some ecological significance. If the snowfall is fairly light evergreen plants can transpire and photosynthesize in a normal manner through these cavities; and if the fall is heavy, the resumption of normal transpiration and photosynthesis will be considerably hastened.

There is one aspect of snow cover which is apt to be overlooked by ecologists and that is its high capacity for reflecting both light and heat. On cloudless days without snow, readings of brightness taken on the summit with a Weston photoelectric exposure meter (the type used in photography) usually vary between 200–400 candles per square foot. On 11 July, 1952, with a completely overcast sky and snow present readings taken in the

Castle Buttress area averaged 200 candles per square foot, and on 24 July, 1952, with a clear sky and snow present readings varied between 800–1,600 candles per square foot. Evergreen alpine plants must clearly be adapted to withstand periods of such high light intensities. As regards heat, Daubenmire (1947, p. 177) states that reflection of radiation from a white snow surface raises considerably the temperature of the air immediately adjacent to it and, because the heating is only temporary, it may prove detrimental to basally situated plant organs.

2.4.4. *Fog*

Fog in the Drakensberg is of two kinds. Firstly, there is summer fog which occurs mainly on the Little Berg and the summit area. This fog is common and may be continuous for two weeks at a time. The low sunshine values in Fig. 2 for the summer months are partly due to this fog. Secondly, there is winter fog which occurs in the main river valleys at night as a result of cold air drainage.

2.5. Humidity

Atmospheric humidity has been recorded at 6,100 ft (1,817 m) on the Little Berg for nearly 10 years. Relative humidites below 30 per cent are common, especially in late winter. Humidities of less than 10 per cent are recorded between about 5 and 10 times annually, while 5 per cent and less is recorded occasionally (Nänni, MS.). The periods of low relative humidity frequently coincide with westerly winds.

2.6. Evaporation

Evaporation is measured on the Little Berg at 6,100 ft (1,817 m) by means of a Symon's evaporation tank. The results (Fig. 5) show that evaporation is highest between September and November. According to Nänni (1956, p. 22) this is partly a result of the strong dry westerly winds blowing water out of the tank rather than of actual evaporation. Mean annual evaporation is 53 in (1,346 mm), which is about equal to the rainfall at the meteorological station.

The importance attached to evaporation or evaporating power of the air in ecology has been questioned in recent years. According to Thornthwaite (1940, p. 22) evaporating power of the air is a theoretical index which is unrelated to actual transpiration. Its only apparent virtue is that it gives a single-value expression for a combination of several climatic factors (Killick, 1959, p. 11), but the Symon's evaporation tank is so defective a measurer of evaporation, that even this virtue is nullified.

The Climate of the Cathedral Peak Area according to the Classifications of Köppen and Thornthwaite

According to Köppen's classification (Schulze, 1947, pp. 33–37) the Cathedral Peak area, like the whole of Basutoland and the interior of Natal, has a Cwb climate i.e. warm [mean temperature of warmest month below 71·6°F (22°C)] with a dry winter, while according to Thornthwaite (l.c., pp. 37–40) it lies along the boundary of the CCd and CBr climates, the former characterizing Eastern Basutoland and the latter Natal. Thornthwaite defines the CCd climate as subhumid cool with insufficient moisture in all seasons, and the CBr climate as subhumid warm with sufficient moisture in all seasons.

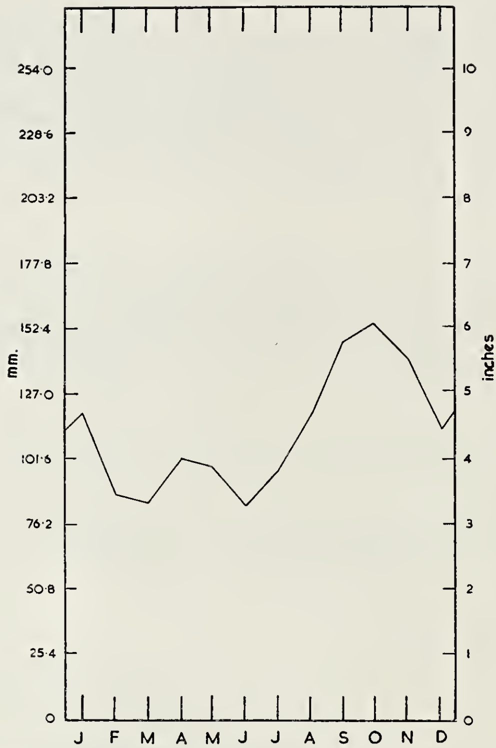

FIG. 5.—Mean monthly evaporation at Cathedral Peak

Comparing the two classifications with reference to the Cathedral Peak area, it would seem that the Thornthwaite classification is the more sensitive: it brings out the fact that Eastern Basutoland is cooler and receives less precipitation than the Natal side of the escarpment. However, the Thornthwaite classification does not, for any part of South Africa, distinguish between summer and winter rainfall climates.

CHAPTER 3

HISTORY OF THE DRAKENSBERG AREA BETWEEN MONT AUX SOURCES AND GIANTS CASTLE

The known history of the Drakensberg area can be divided into three periods, namely, pre-Shakan times, Shaka's reign and its aftermath, and the arrival of the Voortrekkers following European settlement in Natal.

3.1. PRE-SHAKAN TIMES

At the beginning of the nineteenth century Natal, excluding Zululand, was inhabited by the Tekela-speaking branch of the Nguni-Bantu race. According to Bryant (1929, p. 82) the country had a population of about 100,000 inhabitants. The tribes lived in plenty and were at peace with one another. Bryant (1949, pp. 174–263) describes Natal at that time as "Arcady ".

The Drakensberg area between Mont aux Sources and Giants Castle was occupied by the amaZizi, a tribe of the eMbo Nguni group. According to Bryant (1929, p. 355) the amaZizi arrived in the Drakensberg under their chief Langa about the year 1700. In addition to the amaZizi there were the Bushmen. Apparently the amaZizi lived in the river valleys below the Cave Sandstone cliffs and the Bushmen in the region above i.e. the Little Berg. Theal (1915, p. 322) writes: " on the plateau nearest the great range it is so cold in the winter months—May, June, July and August—that the Bantu never cared to live there and the aboriginal Bushmen roamed over it almost unmolested ".

The Bantu were a pastoral people: they owned large herds of cattle, as well as sheep and goats. Grass-burning was a regular feature of their pasture management. Holden (1855, p. 27) states that they burnt the grassland once or twice a year " not all at once, but in sections, so that at all seasons the flocks and herds may have an abundance of fresh grass ". Unlike the Bantu, the Bushmen were not pastoralists, but existed by hunting game.

3.2. SHAKA'S REIGN AND ITS AFTERMATH

The rise to power of Shaka and the Zulus from 1812 onwards brought an abrupt end to the peace of Natal. Briefly, the events which affected the Drakensberg scene were as follows. In 1812 Shaka, then a tributary chief of Dingiswayo, attacked the amaNgwane tribe under Matiwane who were living in the Vryheid district. The amaNgwane fled westwards routing in their turn the large amaHlubi tribe and the amaBele tribe. Eventually the amaNgwane reached the Drakensberg and dispersed the amaZizi. In 1818 Matiwane settled in the Cathkin Peak area, but only for a short time, for in 1822 Shaka's armies swept across Natal uprooting and partly destroying the tribes which they encountered.

By 1830 the Bantu population of Natal had decreased from 100,000 to between 3,000 and 10,000. Theal (1915, p. 354) states that Retief, the Voortrekker leader, who crossed the Drakensberg in 1837, did not encounter any sign of human habitation between the Drakensberg and Port Natal (Durban)—a distance of about 150 miles (240 Km). Some of the fugitive Bantu sought refuge in inaccessible parts of the Drakensberg. Among these was the Duga clan under Mdavu who, facing the prospect of starvation, resorted to cannibalism.

3.3. Arrival of the Voortrekkers

In 1837 the Voortrekkers crossed the Drakensberg into Natal via Bezuidenhouts Pass, Tintwa Pass and Oliviershoek Pass. After subduing Dingaan, Shaka's successor, they declared Natal a republic in December 1838 and immediately commenced farming operations. Farms of 6,000 acres (2,428 Ha) each were alloted to those trekkers who had settled in Natal before the beginning of 1840. A considerable number of the trekkers settled in the deserted foothills of the Drakensberg, mainly in the area between the Tugela and Bushmans Rivers. They considered this area particularly suited to their pastoral pursuits.

In 1843 Natal became a British colony and in 1845 it was annexed to the Cape. Commissioner Cloete, who had the task of settling land claims, ruled that those trekkers who had occupied farms continuously during 1842 were entitled to 6,000 acres (2,428 Ha), but those who had arrived later were only entitled to 2,000 acres (809 Ha). This caused much dissatisfaction among the trekkers.

Meanwhile there had been a large influx of Bantu into Natal—mainly returning refugees. By 1846 there were nearly 100,000 Bantu wandering up and down Natal squatting temporarily wherever the pastures suited them. To accommodate these Bantu the Government in 1846 established seven reserves, one of which, called Kathlamba, was situated in the Drakensberg but had no defined boundaries. Trekkers whose farms lay in these reserves were forced to leave. This, together with Cloete's land settlement and other reasons, caused a mass exodus of trekkers from Natal. Thus for a second time, the interior of Natal was almost denuded of its population.

In February, 1848, the remaining trekkers were on the point of crossing the Drakensberg into the Orange River Sovereignty, but were persuaded to stay by Sir Harry Smith who promised to investigate their grievances. The result was that farms of 2,000 acres (809 Ha) were increased to 6,000 acres (2,428 Ha)—the so-called land commission farms. Protection was guaranteed against the Bantu and a police force was created to check thieving of stock by Bushmen. Smith arranged that as many as possible of the land commission farms should be laid out along the headwaters of the Tugela River and its tributaries, because there were fewer Bantu there than in any other part of Natal. This part of the Drakensberg received therefore, for the first time, a settled European population.

In 1849 the Government established several locations in the Drakensberg area to serve as buffer between the European farmers and the raiding Bushmen. Langalibalele and the remnants of the amaHlubi tribe were settled at the source of the Blauwkrantz River and Munangalala on land along the Bushmans River. This area later became known as Drakensberg Location No. 1. The amaNgweni under Puteni were settled in the upper reaches of the Little Tugela River—now known as Drakensberg Location No. 2. These tribes, especially the amaHlubi, were very largely dispersed as a result of the Langalibalele Rebellion in 1873.

The measures taken against the Bushmen proved all too successful and by 1890 they were completely exterminated (Willcox, 1956, p. 32). From the point of view of the watershed protection, the presence of the Bushmen on the Little Berg for such a long period was very important. The Bushman's penchant for thieving cattle prevented both the Bantu and

the European from farming on the Little Berg. This meant that up to 1890 the vegetation of the upper catchment areas of the Tugela River was never subjected to continuous and selective grazing by domestic stock, indiscriminate cultivation and other farming malpractices, which might have adversely affected streamflow.

The trekkers flourished in the comparatively peaceful years which followed their settlement in the highlands. However, in 1855 lung-sickness broke out among cattle and the trekkers suffered enormous losses. According to Brookes (1876, p. 286) only 4 per cent of the cattle in Natal survived. This outbreak induced the trekkers to turn to sheep which were found to thrive in the highlands of Natal.

Sheep-farming was practised on a large scale until the 1930's. Some of the farmers in the Drakensberg area also owned farms in the North-eastern Orange Free State and the Southern Transvaal. At an early stage the farmers found that winter grazing in the O.F.S. was extremely poor, so they sent their sheep to Natal for the winter months (Thomas, 1904, p. 200).

In order to obtain first-hand information about the annual movement of sheep between Natal and the Orange Free State, the author visited Mr. W. J. Oosthuizen, of the farm Richardspan in the Kransfontein area (Bethlehem District), O.F.S., who farmed in the Cathedral Peak area between 1920 and 1938. Mr. Oosthuizen and several other farmers owned farms both in the Mlambonja Valley at Cathedral Peak and in the Kransfontein area. In March of each year they would ride from Kransfontein to Cathedral Peak, a two-day journey, and burn several spurs of the Little Berg which they would rest the following year. The Little Berg at that time was a public commonage and the farmers each paid the Natal Administration £12 per year for grazing rights. The farmers would then return to the O.F.S., allow sufficient time for the burnt grasses to shoot and then drive their sheep to Cathedral Peak in May. Walking the sheep for only two hours per day the journey took 16–18 days. The route taken was via the Oliviershoek Pass. Each farmer had between 2,000–3,000 head of sheep, consequently there must have been a dense concentration of sheep on the Little Berg during the winter months. The sheep were returned to the O.F.S. in October or November. According to Mr. Oosthuizen the erection of fences en route between their farms in Natal and the O.F.S. finally put a stop to this practice. The practice, however, is still carried out north-east of Mont aux Sources (Scott, 1955, p. 609).

An important statement made by Mr. Oosthuizen was that, even when he first arrived in the Drakensberg, the greater part of the Little Berg and the river valleys at Cathedral Peak was covered by Rooigras (*Themeda triandra*).

To-day most of the high area between Mont aux Sources and Giants Castle is protected and comprises the Royal Natal National Park at Mont aux Sources, the Cathedral Peak and Cathkin Peak Forest Reserves and the Giants Castle Game Reserve. The non-protected areas include native locations and private farms. There are three locations, namely the Upper Tugela Location containing the remnants of the amaZizi and the amaNgwane tribes; Drakensberg Location No. 2 containing the remnants of the amaNgwene tribe, and Drakensberg Location No. 1 containing a mixture of tribes. The private farms are mostly situated below the Cave Sandstone cliffs.

Chapter 4

THE VEGETATION BELTS

Altitudinal zonation of vegetation is characteristic of most mountains of sufficient height. In the Drakensberg the belts are not as clear cut as on many mountains, but they are nevertheless present.

There are several ways of determining the natural limits of vegetation belts. The methods have been reviewed by Hedberg (1951, p. 163). The two most frequently used methods are as follows:—

(i) The first method involves the determination of the vertical distribution of all the plant species and the fixing of the boundaries at contours where the distribution limits of a large number of species coincide. This method, floristic in character, was used with success by Sendtner (1854) in S. Bavaria and van Steenis (1935) in Malaysia.

(ii) In the second method the vegetation belts are made to coincide with the climax formations—an ecological approach.

The second method, the one used in the present work, seems preferable since, as pointed out by Hedberg (l.c., p. 163), the distribution of climax communities can be determined more readily and with greater accuracy than that of individual species.

In the Drakensberg there are three climax communities, viz. *Podocarpus latifolius* Forest (4,200–6,000 ft, 1,280–1,829 m), *Passerina–Philippia–Widdringtonia* Fynbos (6,000–9,400 ft, 1,829–2,865 m) and *Erica–Helichrysum* Heath (9,400– c. 11,000 ft, 2,865–3,353 m), hence there are three belts.

It is desirable to give these belts names which allow for comparison with mountains in other parts of the world. In ascending order the terms used in tropical mountain ecology are tropical, montane, subalpine, alpine and nival. It is generally agreed (Van Steenis, 1935, p. 329 and Hedberg, l.c., pp. 164–166) that the belt below the forest or timber line should be called the montane belt and that above, the alpine belt or, if there are two recognizable belts above, the subalpine and alpine belts. The forest limit in the Drakensberg lies at about 6,000 ft (2,865 m), consequently the *Podocarpus latifolius* Forest Belt is montane; the *Passerina–Philippia–Widdringtonia* Fynbos Belt is subalpine, and the *Erica–Helichrysum* Heath Belt is alpine. The terms tropical and nival obviously do not apply in the Drakensberg.

The use of the term alpine for the uppermost belt of African mountains has been criticized by Boughey (1955, p. 417). Boughey maintains that the term should only be applied to the uppermost belt of the European Alps, but that if it is used for African vegetation, it should be prefixed by afro-, hence afro-alpine, a term first coined by Hauman (1933). The present author considers that the term alpine does not imply a systematic relationship with the vegetation of the European Alps: it simply refers to the low, dwarf vegetation of the belt above the forest limit.

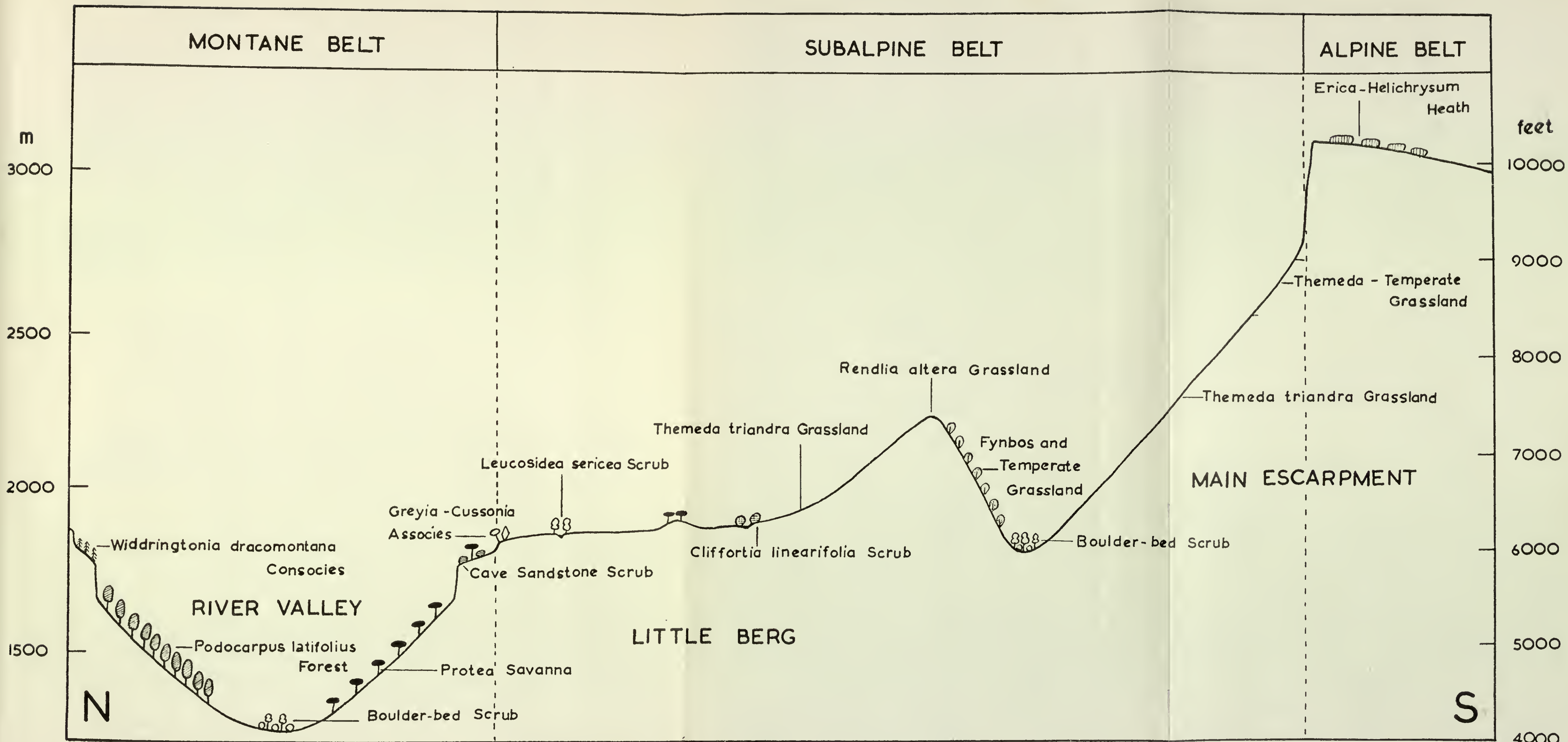

Fig. 6.—Profile through the Drakensberg area showing the vegetation belts with their chief plant communities

Recently Hedberg (l.c., p. 163), in an effort to obtain uniformity of terminology in the description of African mountain vegetation, has redefined some of the basic terms. According to Hedberg a zone is a more or less local altitudinal region the main vegetation of which is clearly distinct from that of adjacent zones, for example the Bamboo Zone of East African mountains. A belt is an altitudinal region which can be traced on all or most mountains of sufficient height in a definite part of the world, for example the Montane Forest Belt. The belts described in the present work clearly fit Hedberg's definition of a belt. However, the term belt suggests a continuity which is lacking in the Drakensberg: the climax community of each of the belts is limited to small, usually sheltered areas between which are vast areas of seral grassland.

An alternative term to belt which has been used by both Schelpe (1946) and West (1951) is formation. However, there are so many different interpretations of a formation (Carpenter, 1938, pp. 113–115, lists eight in his glossary) that the term is best avoided. In spite of the criticism of the term belt already mentioned, it is probably the best term available.

To recapitulate, there are three vegetation belts, viz:—

(i) Montane Belt (4,200–6,000 ft, 1,280–1,829 m),

(ii) Subalpine Belt (6,000–9,400 ft, 1,829–2,865 m),

(iii) Alpine Belt (9,400– c. 11,000 ft, 2,866– c. 3,353 m).

These belts coincide with the three terraces in the Drakensberg, namely the river valley system, the Little Berg and the summit area of the Drakensberg respectively. A profile through the Drakensberg area showing the vegetation belts with their chief plant communities is given in Fig. 6.

Chapter 5

THE MONTANE BELT

5.1. Introduction

The Montane Belt extends from the valley floors to the lowermost basalt cliffs at the edge of the Little Berg, i.e. from 4,200–6,000 ft (1,280–1,829 m).

The greater part of the belt is occupied by tussock grassland, chiefly *Themeda triandra* Grassland, but also *Hyparrhenia* Grassland and *Miscanthidium–Cymbopogon* Grassland. Species of *Protea* are scattered through the grassland to form *Protea* Savanna. The main woody communities are Boulder-bed Scrub, Streambank Scrub, *Leucosidea–Buddleia* Scrub, *Greyia–Cussonia* Associes, Cliff Scrub, *Widdringtonia dracomontana* Consocies and the climax community of the Montane Belt, *Podocarpus latifolius* Forest, which is generally confined to sheltered gorges and kloofs.

5.2. Plant Succession

5.2.1. *The Priseres*

The suggested interrelationships of the plant communities in the lithosere and hydrosere are given in Fig. 7.

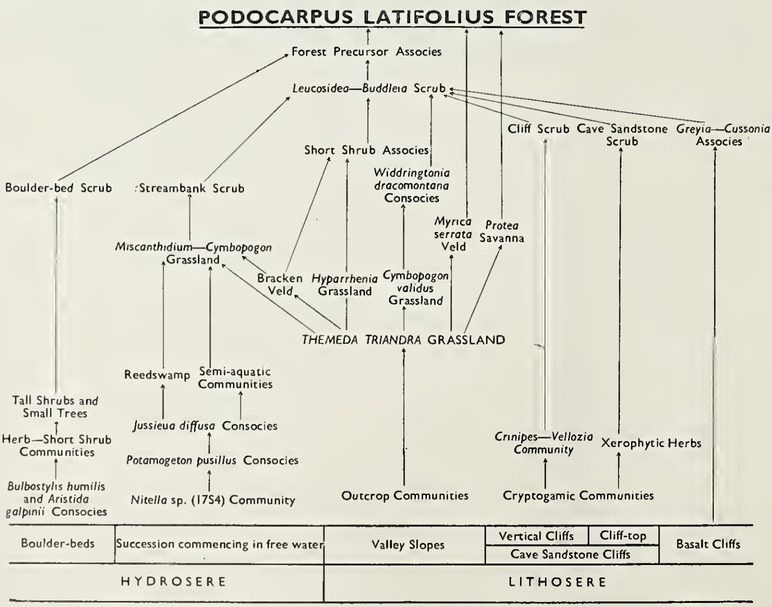

Fig. 7.—Suggested interrelationships of the plant communities in the hydrosere and lithosere in the Montane Belt

5.2.1.1. *Seral Stages*

5.2.1.1.1. *The Hydrosere*

The principal hydroseral areas in the Montane Belt are rivers, streams and vleis. Examples of still water such as lakes and tarns are absent. Schelpe (1946, p. 23) includes the Mushroom Tarn as a primary area of the Montane Belt, but as it is situated on the Little Berg at about 6,200 ft (1,890 m) it should be included in the Subalpine Belt.

Rivers and streams are common in the Cathedral Peak area, but their character is such that aquatic communities are not extensive. The reasons are fairly obvious. The average gradient of the rivers is steep, with the result that the velocity of the current is high and aquatics cannot secure adequate foothold. The volume of water varies tremendously from season to season: in summer the rivers are often torrential while in winter they are low. The structure of the riverbeds changes periodically: where the rivers cut through deep gorges the beds remain fairly stable, but in wide valleys the main water channel is constantly changing its course. The water scours its way through a bed consisting of roundish grey basalt boulders of varying size sometimes arranged in several tiers. During floods these boulders are rarely stationary: the current carries them downstream and the rumble and clatter of their collision is a characteristic sound associated with Drakensberg storms.

Silt-formation under the conditions described is almost impossible, but a considerable amount of coarse sand accumulates between the boulders and, together with the boulders, produces a special habitat where a distinct sere is initiated.

Drainage of valley slopes in the Drakensberg is good, so that vleis are neither abundant nor extensive. Some vleis contain open pools where water is stagnant or flows only slowly. In these pools there is occasionally zonation of aquatic communities, but this phenomenon is best seen in certain sidepools of the main rivers.

The hydrosere will be discussed under two headings, firstly that commencing in free water and secondly that occurring on the boulder-beds of the rivers.

(A) Succession commencing in Free Water

(*a*) Nitella *sp. Community*

The initial stage is represented by the charad, *Nitella* sp. (1754). It occurs as a submerged aquatic usually scattered over the floor of pools 6–9 in (15–23 cm) deep.

(*b*) Potamogeton pusillus *Consocies*

Potamogeton pusillus is a floating, rooted aquatic occurring just below the surface of the water. It forms dense communities up to 2 ft (60 cm) in diameter. This community is very common in the Giants Castle area.

(*c*) Jussieua diffusa *Consocies*

The dominant of this consocies is *Jussieua diffusa*. Anchored in the shallower waters bordering pools, it grows radially towards the centre.

Following this stage is either reedswamp or a stage of semi-aquatics.

(*d*) *Reedswamp*

The dominants of reedswamp are *Phragmites communis* with culms 7–12 ft (2·1–3·7 m) tall, and *Typha capensis* with culms 4–5 ft (1·2–1·5 m) tall. Usually the community is very dense and there is little room for subordinate plants. Reedswamp is usually found in quiet, but not stagnant, side-pools of the main rivers. It is not as extensive in the Drakensberg as it is at lower altitudes in Natal.

(*e*) *Semi-aquatic Communities*

This stage consists of plants growing on soil which is always moist.

Several plants form consocies. *Arundinella nepalensis*, a tall grass up to 4 ft (1·2 m) high is very conspicuous in this stage and forms dense consocies. *Cyperus marginatus* is dominant at the edge of islands in the Mhlwazeni River. It sometimes grows in water. *Digitaria ternata*, a prostrate horizontally spreading grass, colonizes sandy alluvia. *Setaria pallide-fusca* forms a community on the flats adjacent the Mlambonja River. This grass is also characteristic of disturbed areas, so it may well be that these flats were once under cultivation.

Other semi-aquatics forming consocies are *Scirpus macer*, *Fimbristylis dichotoma*, *Rhynchospora brownii*, *Pycreus oakfortensis*, *Juncus punctorius*, *Ischaemum arcuatum* and *Pennisetum natalense*.

There are numerous associates. Arranged more or less in order of importance they include:—

Gumera perpensa
Sium thunbergii
Mariscus congestus
Fuirena pubescens
Epilobium salignum
Pennisetum thunbergii
Imperata cylindrica
Eragrostis planiculmis
Paspalum dilatatum
Agrostis huttoniae
Equisetum ramosissimum
Gnaphalium luteo-album
Diclis reptans
Nidorella polycephala
Geranium caffrum
Oenothera rosea
Hypericum lalandii
Kniphofia longiflora
Conyza gouanii
C. ivaefolia
Zantedeschia albomaculata
Z. oculata
Mimulus gracilis
Pycnostachys reticulata
Helichrysum mundtianum
H. setosum
Athanasia fontana
Eleocharis palustris
Bulbostylis trifida
Senecio erubescens
Gladiolus psittacinus
Artemisia afra
Valeriana capensis
Anthospermum hedyotideum
Habenaria tridens

(*f*) Miscanthidium–Cymbopogon *Grassland*

This grassland is found in moist areas generally—streambanks, gullies and forest margins. The dominants are *Miscanthidium capense* var. *villosum* and *Cymbopogon validus*, both robust grasses, the former up to 8 ft (2·5 m) tall and the latter somewhat shorter. They occur in consocies or associes.

It may be well to mention that *Cymbopogon validus* is the grass which previous workers (Schelpe, 1946, p. 17 and West, 1951, p. 121) have erroneously referred to as *C. marginatus*. *C. marginatus* is a Cape (and possibly Transvaal) species which has not been recorded for Natal (Chippindall, 1955, p. 507).

Cymbopogon validus has a wider habitat range than *Miscanthidium capense* var. *villosum*. Besides growing in damp areas it can grow in comparatively dry situations, for example rock outcrops and cliff ledges. In addition it has a wider altitudinal range: it extends up to 9,000 ft (2,743 m) in the upper part of the Subalpine Belt, whereas *Miscanthidium capense* var. *villosum* rarely occurs above 6,500 ft (1,981 m).

This grassland is soon invaded by a variety of tall herbs and shrubs (Short Shrub Associes, p. 39). A mixed community in *Cymbopogon validus* Grassland which is conspicuous during winter is formed by *Aloe saponaria*, the diffuse-growing *Athrixia phylicaefolia* and *Chrysanthemoides monilifera*.

Miscanthidium capense var. *villosum* and *Cymbopogon validus* are very often associated with *Pteridium aquilinum*. From observations made it seems that these grasses invade Bracken Veld rather than *vice versa*. Schelpe arrived at a similar conclusion (1946, p. 21). It is possible, however, that these species invade *Themeda triandra* Grassland more or less simultaneously.

(*g*) *Streambank Scrub*

Several trees and shrubs invade streambanks and the edges of pools. They do not form a closed community and, being riparian (many, at least) often appear without the prior reaction of the communities already described. Another factor responsible for the early appearance of these plants is the steep nature of many of the streambanks.

The constituent plants of this scrub are *Salix woodii*, *Myrica serrata*, *Ilex mitis*, *Bowkeria verticillata*, *Maytenus acuminatus*, *Cliffortia linearifolia*, *Rhus gerrardii*, *Halleria lucida*, *Sparmannia ricinocarpa*, *Dais cotinifolia* and *Gomphostigma virgata*. The tree fern *Cyathea dregei* is also characteristic of this stage.

Superseding Streambank Scrub is *Leucosidea–Buddleia* Scrub (p. 39).

(B) Boulder-Bed Succession

The boulder-bed of Drakensberg rivers provides a variable habitat. In parts the boulders are widely separated by fairly large stretches of coarse sand. In others the boulders are piled high with little or no intervening sand. Near water the sand is naturally moist, but some distance from it, it can be quite dry—at least in the upper few inches. Percolation of rain-water through the sand is rapid.

The following are the main stages in the succession:—

(*a*) Bulbostylis humilis *and* Aristida galpinii *Consocies*

The first plants to colonize the sand are *Bulbostylis humilis*, a small sedge about 3 in (8 cm) high and *Aristida galpinii*, a tufted xeromorphic grass which, according to Chippindall (1955, p. 312), may be a form of the common and widespread *A. junciformis*. These species usually occur in consocies. Occasionally the gaps between the plants are colonized by the mosses *Campylopus trichodes* and *Bryum argenteum* (Schelpe, 1953, p. 87).

(*b*) *Herb–Short Shrub Communities*

Next in the succession is a mixture of herbs and short shrubs, which reflects the diverse nature of the habitat; some are succulent, others are sclerophyllous while others are mesophytic.

The most characteristic plants are *Aster filifolius*, *Sutera pristisepala*, *Zaluzianskya goseloides*, *Chrysocoma tenuifolia*, *Indigofera longebarbata*, *Senecio haygarthii*, *Sutherlandia montana*, *Glumicalyx montanus* and *Argyrolobium collinum*.

Fairly frequent in this habitat is *Cliffortia filicauloides*, a woody prostrate shrub that spreads itself as a carpet over boulders. Two ferns *Notholaena eckloniana* and *Asplenium splendens* often grow in the shade of boulders.

Less important in this stage are the following species:—

Buchenroedera lotononoides	*Selago monticola*
Crassula sarcocaulis	*Stoebe vulgaris*
C. platyphylla	*Tephrosia polystachya* var. *latifolia*
Lasiosiphon polyanthus	*Galium wittbergense*
Gazania krebsiana	*Andropogon eucomus*
Gymnopentzia pilifera	*Zaluzianskya capensis*
Melolobium obovatum	*Epilobium salignum*
Senecio inornatus (near running water)	*Cliffortia linearifolia*
Erica aestiva	*Phygelius capensis*
Helichrysum splendidum	*Sutera dentatisepala*
H. trilineatum	*Chrysanthemoides monilifera*
Kalanchoe thyrsiflora	

It will be noticed that most of the plants listed belong to the families Compositae, Scrophulariaceae, Crassulaceae and Leguminosae.

Two of the plants mentioned *Glumicalyx montanus* and *Helichrysum trilineatum* are really alpine plants; they have probably reached these lower altitudes by way of water-courses arising on the Natal side of the escarpment.

(*c*) *Tall Shrubs and Small Trees*

Plants of this stage include the recently described *Helichrysum tenuifolium*, which very often forms large and dense consocies up to 6 ft (2 m) high, *Polemannia montana*, *Lotononis* sp. nov. (1191), *Calpurnia intrusa*, *Macowania conferta* and *Buddleia corrugata*, the last-named occurring only above 7,600 ft (2,136 m).

(*d*) *Boulder-bed Scrub*

Finally *Leucosidea sericea* or *Bowkeria verticillata* appear and form what can conveniently be called Boulder-bed Scrub (Plate 7). *Bowkeria verticillata* becomes more important at higher altitudes. The community is 10–15 ft (3–4·6 m) high and has a variable spacement.

Mature Boulder-bed Scrub has an understorey of *Aristida monticola* and, to a lesser extent, *Cymbopogon validus*. In parts of the Ndedema Valley the community might more accurately be described as woodland: *Leucosidea sericea* is closely scattered through a dense sward of *Aristida monticola*. At higher altitudes *Pentaschistis pilosogluma* and *Danthonia disticha* become increasingly important.

This scrub is liable to invasion by forest or fynbos depending upon altitude. Indicators of forest include *Buddleia salviifolia, Rhus dentata, Euclea lanceolata* and *Rhamnus prinoides,* and of fynbos *Passerina montana, Erica ebracteata* and *Anthospermum aethiopicum.*

5.2.1.1.2. *The Lithosere*

Primary rock areas in the Montane Belt are both abundant and diverse. The different rock habitats with their respective seres will be described under the following headings:—

(A) Valley Slopes,

(B) Cave Sandstone Cliffs, and

(C) Lowermost Basalt Cliffs.

(A) Valley Slopes

Under this heading is included the valley slopes between the main rivers and the lowermost basalt cliffs. Primary rock areas here are limited to outcrops in grassland. The stages preceding *Podocarpus latifolius* Forest are as follows:—

(*a*) *Outcrop Communities*

The pioneers of rock outcrops are chiefly xerophytic grasses occurring in consocies or associes. They include *Aristida galpinii, Eragrostis racemosa, Loudetia simplex, Digitaria monodactyla* and *Rhynchelytrum setifolium.* Also present are *Schizocarphus rigidifolius* and *Clutia monticola.*

(*b*) Themeda triandra *Grassland*

Themeda triandra Grassland covers most of the river valley area of the Drakensberg. Usually it forms an understorey to *Protea* Savanna.

An area of grassland behind the Research Officer's residence was selected as representative of *Themeda triandra* Grassland of the Mlambonja Valley and was analysed on 27 November, 1953, by means of the Wheel Point Method of Tidmarsh & Havenga (1955). Two thousand points were taken and the results are given in Table 4. Forty-four species were struck of which 21 were grasses. The total basal cover is 33·8 per cent with *Themeda triandra,* the dominant, contributing 8·3 per cent. The most important grasses are *Themeda triandra, Tristachya hispida, Hyparrhenia hirta, Ischaemum franksiae, Andropogon filifolius, Harpechloa falx* and *Rendlia altera.* The average leaf height of the sward is 9–12 in (22·8–30·5 cm) and culm height is 2–3 ft (0·6–0·9 m).

Grasses which occur in *Themeda triandra* Grassland, but which were not recorded in the analysis are *Paspalum dilatatum, Brachiaria serrata, Digitaria diagonalis, Monocymbium ceresiiforme, Eulalia villosa, Eragrostis curvula* and *Sporobolus pyramidalis. Monocymbium ceresiiforme* shows a preference for moist areas and is sometimes locally dominant. Footpaths in grassland are frequently lined with *Eragrostis curvula* and *Sporobolus pyramidalis.*

TABLE 4.—Wheel Point Analysis of *Themeda triandra* Grassland in the Mlambonja Valley

Species	Percentage Basal Cover
Themeda triandra	8·30
Tristachya hispida	3·75
Bulbostylis trichobasis	3·00
Hyparrhenia hirta	2·60
Ischaemum franksiae	2·55
Andropogon filifolius	1·95
Harpechloa falx	1·70
Rendlia altera	1·45
Digitaria flaccida	0·80
Eragrostis racemosa	0·80
Trachypogon spicatus	0·75
Michrochloa caffra	0·65
Alloteropsis semialata	0·60
Panicum ecklonii	0·60
Loudetia simplex	0·50
Eragrostis capensis	0·45
Eriosema kraussianum	0·30
Acalypha depressinervia	0·25
Helichrysum aureonitens	0·25
Panicum natalense	0·25
Polygala rehmannii	0·20
Pygmaeothamnus chamaedendrum var. *setulosus*	0·20
Scleria bulbifera	0·20
Elyonurus argenteus	0·15
Helichrysum allioides	0·15
Senecio bupleuroides	0·15
Becium obovatum	0·10
Digitaria tricholaenoides	0·10
Helichrysum oreophilum	0·10
Heteropogon contortus	0·10
Schizocarphus rigidifolius	0·10
Vernonia krausii	0·10
Aster perfoliatus	0·05
Aster sp.	0·05
Barleria monticola	0·05
Callilepis laureola	0·05
Commelina africana	0·05
Gerbera natalensis	0·05
Helichrysum adenocarpum	0·05
Hypoxis acuminata	0·05
Hypoxis sp.	0·05
Koeleria cristata	0·05
Eulophia leontoglossa	0·05
Pentanisia prunelloides	0·05
Rhynchelytrum setifolium	0·05
TOTAL	33·80

Associated plants are common. Forbs which form socies in *Themeda triandra* Grassland include:—

Eriosema kraussianum	*Barleria monticola*
Acalypha depressinervia	*Callilepis laureola*
A. punctata	*Thesium racemosum*
Helichrysum aureonitens	*Pentanisia prunelloides*
H. oreophilum	*Graderia scabra*
H. allioides	*Cyperus compactus*
Becium obovatum	*Eulophia leontoglossa*

Forbs which occur casually without aggregating are:—

Polygala rehmannii	*Tetraria cuspidata*
Aster perfoliatus	*Pelargonium alchemilloides* var. *dentatum*
Gerbera natalensis	*Hypoxis* spp.
Buchnera dura	*Eriospermum cooperi*
Striga elegans	*Vernonia pinifolia*
Eulophia foliosa	*Habenaria dregeana*
E. zeyheri	*Lasiosiphon caffer*
Schizoglossum woodii	*Arthrosolen microcephalus*
S. pulchellum	*Pterygodium hastatum*
Sisyranthis imberbis	

A very attractive and dense socies is formed by *Curtonus paniculatus*, which usually grows just below the Cave Sandstone cliffs. This monocotyledon is 3–4 ft (0·9–1·2 m) tall and has panicles of orange flowers.

Most of the associated plants are perennials with substantial underground storage organs. Some have surprisingly large underground parts, for example *Callilepis laureola*, a composite, has an obconical woody rootstock about 1 ft (30·4 cm) long and 6 in (15·2 cm) in diameter at the top.

Large areas of *Themeda triandra* Grassland are occupied by *Pteridium aquilinum*, the Bracken Fern. Usually the areas are moist and have deep soil. *P. aquilinum* eventually closes up and, with numerous associates, mainly tall herbs and semi-woody plants, supersedes the grassland to form a stage transitional to forest. This stage will be dealt with later.

Protection from fire, partial or complete, affects the composition of *Themeda triandra* Grassland. The grassland in the vicinity of the Masongwaan and Indumeni Forests has been partially protected from fire for many years because it is near natural forests which are being conserved. This grassland is rank and consists mainly of *Trachypogon spicatus*, *Alloteropsis semialata*, *Ischaemum franksiae*, *Eulalia villosa* and *Elyonurus argenteus*. Of these grasses only *Ischaemum franksiae* has a basal cover of more than 1 per cent in the frequently burnt grassland analysed in the Mlambonja Valley (see Table 4). *Eulalia villosa* does not appear in the analysis yet assumes co-dominance when the grassland is protected. *Themeda triandra*, the dominant of *Themeda triandra* Grassland has disappeared almost entirely. West (1951, p. 83) found a very similar situation at Tabamhlope. He states that the grasses which disappear in grassland which is protected from both fire and grazing are *Themeda triandra*, *Heteropogon contortus*, *Monocymbium ceresiiforme*, *Eragrostis racemosa* and *Digitaria tricholaenoides*, while the grasses which persist are *Trachypogon spicatus*, *Alloteropsis semialata*, *Harpechloa falx*, *Panicum natalense* and *Koeleria cristata*.

With complete protection from fire, species of *Hyparrhenia* appear and eventually *Hyparrhenia* Grassland (p. 38) is formed. Alternatively in moister areas *Themeda triandra* Grassland is succeeded by *Miscanthidium*—*Cymbopogon* Grassland or Bracken Veld.

Acocks (1953, pp. 119, 148) has classified the lower altitude grasslands of the Drakensberg into Southern Tall Grassveld between 3,500–4,500 ft (1,067–1,372 m) and Highland Sourveld between 4,500–7,000 ft (1,372–2,133 m). Actually Tall Grassveld is found right up to 6,000 ft (1,829 m), consequently the whole of the grassland area of the Montane Belt should be designated as Southern Tall Grassveld. The composition of Southern

Tall Grassveld as given by Acocks approximates very closely to that obtained for the Mlambonja Valley. He describes this veld as " sourish mixed grassveld ": this is revealed by the presence of typical sourveld indicator species such as *Tristachya hispida*, *Elyonurus argenteus* and *Trachypogon spictatus*, which become more important in the *Themeda triandra* Grassland of the Little Berg i.e. true Highland Sourveld. From a grazing point of view the chief characteristic of sour or sourish grassland is its unpalatability during winter.

Bews (1918, p. 138) describes this grassland as Mountain Tussock Veld. Tussock Grassland is characteristic of mountain areas all over the world and of certain lowland areas as well, but the development and structure of this type of grassland is not always the same. The Tussock Steppe of New Zealand consists of bunch grasses which owe their raised structure to surface erosion (Cockayne and Laing, quoted by Bews, 1917, p. 532). The " knee-high " tussocks of *Nardus stricta* in Europe are formed through excessive accumnlation basally of dead shoots and soil (Tansley, 1939, p. 515). Tussock grassland in the Drakensberg shares features with both these types of grassland. The constituents are mostly densely tufted bunch grasses. Bews (1918, p. 138) states that the old leaf bases persist forming dense stools or tussocks. However, this is not really the case: accumulation of dead parts is prevented by frequent burning of the grassland. Bayer (1955, p. 545) writes: " on account of the steepness of the mountain-sides the soil between the grass tufts is eroded away and deposited on tufts lower down the slopes. In this way the grass tufts are gradually raised above the general soil level forming tussock grassland ". This process of erosion and deposition can be clearly seen during and immediately after heavy storms. The solid part of the grass tussock is very rarely more than a few inches high. The illusion of very high raised tussocks is probably heightened by the fact that the grasses are situated on the steps or miniature terraces described on p. 10. Thus grasses on one terrace would be situated as much as 8 in (20 cm) above grasses on the terrace immediately below.

The Status of *Themeda triandra* Grassland

Themeda triandra Grassland is a relatively stable community which is prevented from successional development by recurrent grass fires. In the terminology of Clements (1916, p. 107) it constitutes a fire subclimax or more strictly, a fire serclimax, since the community is several stages inferior to the climatic climax, *Podocarpus latifolius* Forest. In the terminology of Tansley (1935, p. 292) it is a fire climax.

Fires in the Drakensberg occur either naturally or are caused by man (see p. 102). An important cause of natural fires is lightning. Lightning-induced fires usually occur in early spring when the grass sward is dry and inflammable. The Forestry Department at Cathedral Peak have on record several instances of grass fires being started by lightning. In South Africa lightning-induced fires are more frequent than might be imagined. Table 5 gives the number of fires caused by lightning on forest stations in South Africa during the period 1955–1959 inclusive (figures supplied by the Forestry Department, Pretoria). It should be pointed out that these forest stations cover only 5 per cent of the total land area of South Africa.

TABLE 5.—Number of lightning-induced fires recorded on forest stations in South Africa, and expressed as a percentage of the total number of fires

Year	Number	Percentage
1955	10	6·3
1956	27	11·7
1957	35	16·9
1958	22	13·2
1959	36	13·5

Natural fires also occur when boulders rolling down hill-slopes collide with one another or with stationary boulders producing sparks which ignite the grass sward (Nänni, 1956, p. 24).

It is probable that natural fires have been a factor of the environment ever since the climate included a dry season. If this is the case, then it can be reasonably assumed that in the present climatic set-up grassland, and not forest or scrub-forest as contended by Acocks (1935, pp. 119, 148), has been the predominant community on the slopes below the main escarpment. Bayer (1955, p. 547) makes the comment that the whole behaviour of vernal aspect forbs in grassland suggests that spring burning (through lightning) is a natural factor of the climate.

(*c*) Protea *Savanna*

Two species of *Protea, Protea multibracteata* and *P. roupelliae*, invade *Themeda triandra* Grassland to form a characteristic and very attractive orchard community (Plate 8). The community is found in most river valleys in the Drakensberg, but is best developed between the spurs of the Little Berg.

The two species occur either together in associes or separately in consocies. *P. multibracteata* is the commoner species and has the wider ecological amplitude. *P. roupelliae* seems to prefer Cave Sandstone derived soils: it is abundant in the vicinity of the Cave Sandstone cliffs. The trees are evergreen, about 10–12 ft (3–3·7 m) high, have rounded crowns and on the whole are fairly widely spaced.

The density of *Protea* Savanna depends very largely upon the factor of grass fires. The *Protea* trees are relatively fire-resistant: they have bark up to $\frac{3}{4}$ in (2 cm) thick. But if the fires are sufficiently fierce even this feature does not help them and they succumb. In the Giants Castle Game Reserve the *Protea* trees have closed up to form a particularly dense community. Mr. E. S. Thrash, the former conservator, attributes this to two factors:—

(1) Annual burning of the grassland. If the grassland is burnt every year, the volume and cover of the sward deteriorate, with the result that fires cannot burn so fiercely and the *Protea* trees and seedlings are better able to survive.

(2) Down-slope burning of the grass. It is well known that fires burning downhill burn with less intensity than those burning uphill.

Dense *Protea* Savanna also occurs where the grassland has been completely protected for some time, for example the Masongwaan Valley. However, this is a very rare situation in the Cathedral Peak area. Usually the grassland in the river valleys in the Forest Reserve area is burnt biennially and the result is an open *Protea* Savanna.

An important point which has been made by Schelpe (1946, p. 31) is that *Protea* Savanna, though it precedes forest, is not strictly seral to forest. As Schelpe puts it, it is only " passively seral ". What he means is that the *Protea* trees do not themselves react appreciably upon the habitat to produce conditions favourable for the development of forest: progress towards forest depends upon the successional development, via the usual stages, of the grassland understorey. Thicket or clump formation, which is so characteristic of *Acacia* Savanna, does not seem to be a feature of *Protea* Savanna.

A plant which commonly forms socies under *Protea* trees is *Rubus ludwigii.* It is almost a truism that wherever one sees a circular patch of *R. ludwigii* in *Themeda triandra* Grassland, a *Protea* tree or stump will be found in the centre. *R. ludwigii* is dispersed by birds.

Pollination of *Protea* species is usually attributed to birds, chiefly sunbirds. The Malachite Sunbird is a frequent visitor to the Drakensberg *Proteas.* However, it is probable that a metallic-blue beetle, *Melyris natalensis*, also assists in pollination. Heads of the Drakensberg *Protea* species invariably contain large numbers of this insect. Dr. G. van Son, entomologist at the Transvaal Museum, has informed the author that he has frequently found species of *Melyris* in the heads of Transvaal *Protea* species.

During winter the leaves of *Protea* trees are sometimes infested with the bug, *Antestia orbitalis*—without any obviously harmful effect.

(*d*) Myrica serrata *Veld*

Myrica serrata, a shrub 4–10 ft (1·2–3 m) high, is normally a stream-bank plant, but occasionally it invades *Themeda triandra* Grassland to form a short orchard community. A small patch of this community is situated on a south-east-facing slope in the Indumeni Valley close to the Indumeni Forest.

(*e*) *Bracken Veld*

As indicated on p. 35 this community, about 3 ft (0·9 m) high, generally occurs on deep, moist soil. *Pteridium aquilinum* readily invades *Themeda triandra* Grassland. The reasons are twofold. Firstly, it is an extremely mobile species and secondly, by virtue of its very long subterranean rhizomes it is able to survive grass fires.

Under favourable conditions the plants close up and their fronds eventually overlap to such an extent that the grasses are shaded out and the ground is left almost bare. The reaction of *Pteridium aquilinum* on grassland has been studied more closely in the Subalpine Belt, and will be discussed later (p. 77).

(*f*) Hyparrhenia *Grassland*

This grassland is not very extensive in the Drakensberg area, because of frequent burning. It has a patchy distribution occurring in moist gullies, immediately at the foot of cliffs and other vertical declivities, and in disturbed areas generally, for example, roadsides and between cultivated fields.

The dominant grasses are species of *Hyparrhenia*, namely *H. hirta*, *H. dregeana*, *H. glauca*, *H. tamba* and *H. aucta*. They occur in dense consocies or associes and range in height from 2 ft 9 in (0·8 m) for *H. hirta* to 9 ft (2·7 m) for *H. glauca*. These grasses are all late summer or autumn flowering. Only *H. aucta* extends above 6,000 ft (1,829 m) into the Subalpine Belt.

This community is not as rich in accompanying species as its counterpart in moister areas, *Miscanthidium—Cymbopogon* Grassland.

(*g*) *Mixed Short Shrub Associes*

Miscanthidium—Cymbopogon Grassland, *Hyparrhenia* Grassland and Bracken Veld are invaded by a heterogeneous assemblage of herbaceous and woody plants. Many of these plants are tall autumnal aspect forbs, some are shrubs, while others are low growing shade plants. Together they form a sometimes impenetrable, tangled scrub.

Only occasionally is one species dominant over a large area. Constituents arranged more or less in order of importance are:—

Athanasia punctata	*Agrimonia eupatoria* var. *capensis*
Polygala virgata	*Peucedanum caffrum*
P. myrtifolia	*Anemone fanninii*
Euphorbia epicyparissias	*Berkheya macrocephala*
Artemisia afra	*B. speciosa*
Myrsine africana	*Geranium ornithopodum* var. *album*
Buchenroedera lotononoides	*Wahlenbergia undulata*
Plectranthus grallatus	*Anthospermum herbaceum*
P. calycinus	*Agapanthus campanulatus*
Indigofera longebarbata	*Mariscus congestus*
I. hedyantha	*Mohria caffrorum*
Psoralea caffra	*Galium wittbergense*
Philippia evansii	*Chrysanthemoides monilifera*
Stachys albiflora	*Rhus discolor*
Helichrysum umbraculigerum	*Ochna atropurpurea*
H. setosum	*Sebaea macrophylla*
H. tenax	*Diclis reptans*
Alepidea amatymbica	
Calpurnia intrusa	

(*h*) Widdringtonia dracomontana *Consocies*

In the Montane Belt this consocies, about 10–15 ft (3–4·6 m) high, occurs between the Cave Sandstone and the lowermost basalt cliffs. Succeeding *Cymbopogon validus* Grassland it forms a dense community very often with a shrub layer of *Myrsine africana*, 3–5 ft (0·9–1·5 m) high.

Schelpe (1946, p. 40) states that *Widdringtonia dracomontana* is " possibly, though improbably seral to forest ". It definitely is seral: in the upper reaches of the Masongwaan Valley the succession from *Themeda triandra* Grassland to *Podocarpus latifolius* Forest via *Cymbopogon validus* Grassland, the *Widdringtonia dracomontana* Consocies, *Leucosidea sericea* Scrub and the Forest Precursor Associes can be very clearly seen (Plate 9).

(*i*) Leucosidea–Buddleia *Scrub*

Leucosidea sericea and *Buddleia salviifolia*, both grey-leaved trees or shrubs 10–15 ft (3–4·6 m) high form consocies or associes wherever soil moisture conditions are above average and there is protection from fire.

Buddleia salviifolia seems to be more tolerant of dry conditions; this is evidenced by its frequent association with *Cymbopogon validus* rather than *Miscanthidium capense* var. *villosum.* According to Bews (1917, p. 543) *Leucosidea sericea* Scrub is the most extensive of the tree " associations " in the mountain region.

In the Montane Belt this community is rarely pure: it is soon invaded by forest precursor species such as *Rhamnus prinoides, Euclea lanceolata, Rhus dentata* and *Olinia emarginata.* In the lower ecotonal region of the Subalpine Belt, however, it is frequently pure.

(B) Cave Sandstone Cliffs

The vegetation of the Cave Sandstone cliffs can be divided into two distinct elements—that occurring on the vertical faces and that occurring on the cliff tops. These elements will be discussed separately.

(1) *Vegetation of Vertical Faces*

The Cave Sandstone cliffs up to 500 ft (152 m) high, sheer in parts, but broken by ledges, crevices and pockets in others, provide a variety of habitats which finds expression in the extremely mixed nature of the vegetation. Variations of habitat are also induced by differences in exposure, insolation and degree of dryness or wetness. These cliffs are much frequented by birds, for example the Cape Rock Pigeon and Rameron Pigeon, which doubtless bring seeds and fruits from adjoining areas.

Succession on these cliffs does not always involve a series of stages before the climax is reached: as is often the case with rock habitats the succession can be haphazard with climax plants making a very early appearance. The stages are as follows:—

(*a*) *Cryptogamic Communities*

The first plants to invade the bare rock are algae, chiefly blue-green algae, and lichens. The algae show up very conspicuously as longitudinal black striations marking the cliff face. Bews (1917, pp. 553–554) lists the following algae at 6,000 ft (1,829 m): *Stigonema informe, S. hormoides, Schizothrix epiphytica, Glococarpa sanguinea* and *Calothrix parietina* var. *africana.*

Bews states that the lichens on the Cave Sandstone cliffs arise from the invasion of Cyanophyceae by fungi, but according to Schelpe (1946, p. 43) none of the lichens which he examined contained as algal constituent any of the Cyanophyceae listed by Bews. The lichen flora of the Cave Sandstone cliffs consists almost entirely of crustaceous lichens; foliose lichens are few and dendroid lichens are apparently absent.

Next in the succession are mat-forming bryophytes, details of which are lacking.

(*b*) Crinipcs—Vellozia *Community*

Following the cryptogams are *Crinipes gynoglossa* and *Vellozia viscosa.* These plants form thick, peaty mats which frequently cover large areas of vertical or nearly vertical cliff face (Plate 10). They occur in consocies or associes.

Crinipes gynoglossa is a xeromorphic densely tufted grass with hard filiform leaves. The rootstock, up to 5 in (12·7 cm) long, is surrounded by a dense sheath of old leaf fibres which often extends several inches below the base of the rootstock (Plate 11). The length of the tunic is some indication of the extent to which the mat has thickened during the life of the grass. Tunic-grasses are characteristic of mountain regions the world over. According to Warming (1909, p. 119) the investing tunics store water which can be used in times of need.

Vellozia viscosa is a rosulate plant with hard leaves and attractive blue flowers. Like *Crinipes gynoglossa* it forms tunics.

(*c*) *Herb Communities*

The mats formed in the preceding stage are invaded by a number of herbs. The chief herbs of dry parts of the cliff are *Aristida galpinii*, *Rhynchelytrum setifolium*, *Cymbopogon validus*, *Hyparrhenia hirta*, *Eragrostis* sp. (2127), *Helichrysum randii*, *Scilla natalensis*, *Chrysanthemoides monilifera* and *Cyathula uncinulata*. In moist parts are *Agapanthus campanulatus*, *Pentamenes* sp. (2313) and *Acidanthera* sp. (1934). Occasionally *Acidanthera* sp. directly invades moss mats, but it is not as important here as in the Subalpine Belt. A plant which forms pendulous cushions from the cliff face is *Helichrysum sutherlandii*. Two ferns *Pityogramma austro-americana* and *Blechnum punctulatum* are occasionally found in moist rock crevices. Most of the plants mentioned in this stage can occur as chasmophytes.

(*d*) *Cliff Scrub*

Shrubs and small trees then enter the sere. They form an open scrub and include *Diospyros lycioides* subsp. *sericea*, *Cyathea dregei*, *Metalasia muricata*, *Aloe arborescens*, *Solanum giganteum*, *Hemizygia elliotii*, *Dovyalis zeyheri*, *Cussonia paniculata*, *Greyia sutherlandii*, *Protea multibra teata*, *P. roupelliae*, *Widdringtonia dracomontana* and *Encephalartos ghellinckii*. Characteristic of this scrub is the prostrate *Ficus ingens*, which spreads itself over rock faces.

Finally a very stunted *Podocarpus latifolius* Consociation appears via *Leucosidea–Buddleia* Scrub and the Forest Precursor Associes.

Blocks or boulders of Cave Sandstone which have become detached from the cliffs are frequent on the slopes below the cliffs. They support any of the plants mentioned. The vegetation of these boulders is afforded considerable protection from fire. Schelpe (1946, p. 44) has pointed out that these groups of plants are important as centres from which forest can develop, that is providing the surrounding grassland is given a chance to advance serally.

Caves, or more precisely, overhangs support their own flora. Moist parts of the floor where there is seepage of water support colonies of *Crassula umbraticola*, a small 4 in (10·2 cm) high non-succulent *Crassula* with white flowers. Also growing in moist parts are *Tetraria* sp. (1596) and the ferns *Athyrium schimperi* and *Adiantum poiretii*. *Athrixia pinifolia* occasionally grows on the walls of overhangs—usually in moist crevices. Certain parts of the floor receive moisture only when strong winds drive in rain; the soil is extremely dry and powdery and is the haunt of the ant-lion. Growing here is *Sutera floribunda*.

(2) *Vegetation of Cliff Top*

The area immediately surmounting the Cave Sandstone cliffs provides a considerable area for lithoseral succession. The Cave Sandstone is here exposed to form horizontal or sloping pavements, and small broken areas resembling scree and consisting of angular pieces of Cave Sandstone 3–4 in (7·6–10·1 cm) in diameter. The stages in the succession are as follows:—

(*a*) *Cryptogamic Communities*

The first plants to invade the pavements are cryptogams. Crustaceous lichens form white mosaics on the bare rock and they are followed by two bryophytes, *Campylopus trichodes* and *Hyophila zeyheri*. *Campylopus trichodes* is the more important species and forms very extensive mats.

(*b*) *Xerophytic Herbs*

The next stage is one of xerophytic grasses and sedges and a heterogeneous mixture of herbs. The grasses include *Aristida galpinii*, *Crinipes gynoglossa*, *Loudetia simplex*, *Rhynchelytrum setifolium*, *Microchloa caffra* and *Panicum natalense*. Only two sedges are present namely *Bulbostylis humilis* and *Ficinia stolonifera*. Very characteristic of the Cave Sandstone pavements are the extensive carpets formed by two composites, *Helichrysum albirosulatum* and *H. nanum*. The former in particular with its numerous closely aggregated silvery-white rosettes is very conspicuous. Other composites present are *Helichrysum randii*, *Ursinia alpina*, *Aster perfoliatus*, *A. muricatus* var. *fascicularis*, *Berkheya rhapontica*, *Helichrysum adenocarpum*, *Dicoma anomala* and *Euryops pedunculari*s.

The remaining herbs are:—

Watsonia socium
Psammotropha myriantha
Wahlenbergia montana
Restio fruticosus
R. sieberi var. *schoenoides*
Tetraria cuspidata
Crassula muscosa
C. vaginata
Aeolanthus canescens
Muraltia lancifolia
Kalanchoe thyrsiflora
Pellaea calomelanos
P. quadripinnata
Mohria caffrorum
Erica cerinthoides
Delosperma obtusum
Scilla spp.

(*c*) *Cave Sandstone Scrub*

Finally woody plants enter the sere and form an open type of scrub, which can conveniently be called Cave Sandstone Scrub (Plate 12). This scrub consists of *Protea roupelliae* and *Myrica pilulifera* var. *puberula*, both trees (at least potentially so in the case of the latter), *Cliffortia linearifolia*, *Passerina montana*, *Erica drakensbergensis* and *E. westii*, all sclerophyllous shrubs. Associated with these plants are *Metalasia muricata*, *Hemizygia elliottii*, *Aloe arborescens*, *Helichrysum tenax*, *Lasiosiphon polyanthus*, *Ficus ingens* and an occasional *Widdringtonia dracomontana*.

Good examples of Cave Sandstone Scrub are to be found above the mountain road cutting in the Indumeni–Ofandweni Valley and the Hospital Spruit–Stable Caves area. In the latter area *Restio fruticosus*, *R. sieberi* var. *schoenoides* and the succulent *Delosperma obtusum* are very common.

Protea roupelliae can establish itself in the narrowest of rock crevices. The main root grows straight down for several feet, while the lateral roots spread superficially. Frequently all the roots are superficial. This probably accounts for the facility with which *P. roupelliae* is uprooted by wind at the edge of the Little Berg.

The broken areas are colonized chiefly by *Helichrysum randii*, a lateral spreading composite, but also by *Stoebe vulgaris*, *Aristida galpinii*, *Loudetia simplex*, *Hyparrhenia hirta*, *Hemizygia elliottii*, *Cyathula uncinulata*, *Lotononis eriantha*, *Chrysanthemoides monilifera*, *Anisotoma pedunculata* and *Euryops pedunculari*s.

(C) Lowermost Basalt Cliffs

The lowermost basalt cliffs are situated at the extreme edge of the Little Berg at approximately 6,000 ft (1,829 m). They are dark-coloured, about 15–20 ft (4·6–6·1 m) high and, compared with the Cave Sandstone below, are inconspicuous. Usually the cliffs are broken and often they are almost obliterated by soil. Only the vertical faces will be considered here, since the outcrops along the cliff top belong to the Subalpine Belt.

The vegetation of these cliffs (Plate 13) is much the same as that of the Cave Sandstone cliffs.

The main difference is that *Greyia sutherlandii* and *Cussonia paniculata* form a distinct and extensive community. *Greyia sutherlandii* is a shrub or small tree about 12 ft (3·7 m) high with a short bole and spreading crown. It has attractive racemes of red flowers. This plant gives off a characteristic " sweet " perfume even when not in flower. *Cussonia paniculata* is a 1 or 2-stemmed tree about the same height as *Greyia sutherlandii* with a small crown which casts deep shade; the foliage is glaucous-grey. The community is usually fairly open. Under favourable conditions, that is on mesic aspects, it is superseded by forest.

In addition to the plants listed for the Cave Sandstone cliffs the following species are present: *Diospyros whyteana* (much dwarfed), *Phytolac a* sp. (3437), *Myrica pilulifera* var. *puberula*, *Bowkeria verticillata*, *Psoralea caffra*, *Osyris compressa*, *Notholaena eckloniana*, *Myrsine africana*, *Maytenus acuminastu*, *Aloe pratensis*, *Watsonia socium*, *Haemanthushirsutus*, *Brunsvigia natalensis* and in wet places *Galtonia viridiflorum* and *Carex zuluensis*. The three monocotyledons, *Aloe pratensis*, *Brunsvigia natalensis* and *Haemanthus hirsutus*, are very characteristic of the basalt cliffs and are apparently restricted to them.

5.2.1.2. *The Climax:* Podocarpus latifolius *Forest*

5.2.1.2.1. *Introduction*

Podocarpus latifolius Forest is the climax community of the Montane Belt. It is very limited in extent occurring on streambanks, in deep kloofs and gorges and on slopes with a southern, south-eastern or eastern aspect—wherever conditions are sufficiently mesic and there is adequate protection from wind and fire. The upper limit of *Podocarpus latifolius* Forest in the Cathedral Peak area is about 6,100 ft (1,859 m).

Soil conditions have already been described on p. 8. To recapitulate, they are briefly as follows: the soil is reddish in colour, it has a clay texture, exchangeable base and total adsorbed base values are low, soil reaction is acid (pH 5·0–5·2), humus content is low and drainage is good.

Forests frequently commence their development immediately below waterfalls spilling over the Cape Sandstone or lowermost basalt cliffs. From here they spread laterally along the foot of the cliffs and downwards along streambanks and rivers. With further progress the perimeter assumes a distinctly triangular outline, the base of the triangle being uppermost. Eventually the grassland on the ridges between these triangular patches yields to forest and a continuous strip of forest is formed.

The most important forests in the Cathedral Peak area are the Ndedema Gorge Forest (Plate 14), the Oqalweni Forest, the Indumeni Forest and the Masongwaan Forest (Plate 15). The first-named forest covers an area of about 300 acres (121 Ha) and is probably the largest of the four.

Fourcade, in his " Report on the Natal Forests " (1889, p. 16) refers very briefly to the forests of the Drakensberg. He defines them as " High Timber Forests " and states: " In the Zikali Location, the forests are numerous but all of small size; they occupy deep gorges on the northern flanks of the Drakensberg Mountains . . . The most accessible forests have been cut out, or nearly so, and Kafir cultivation and wattle-cutting have served to damage the greater number ".

Like most forests in South Africa, indeed in Africa as a whole, *Podocarpus latifolius* Forest is mixed in character. The conifer, *Podocarpus latifolius* (Upright Yellowwood), forms a clear majority of the whole tree population, but only in very small areas is it purely dominant. Associated with *P. latifolius* are some 20 species most of them evergreen.

There are two possible reasons for the mixed nature of *Podocarpus latifolius* Forest. Firstly, there is the factor of selective exploitation. *P. latifolius* in times past was much used in building and was consequently heavily exploited. Forests in the Drakensberg, for example the Indumeni Forest, often contain saw-pits indicating that heavy wood was cut out. According to Bulpin (1953, p. 233) there was a flourishing timber-cutting industry in the mountains in the 1860's. If selective exploitation is not the cause, then it may be as Aubréville (quoted by Richards, 1952, p. 262) suggests, that abundant species have very similar ecological requirements and respond in very similar ways to slight variations in environment. Under these conditions the composition of mixed forest would fluctuate in space and probably in time as well.

The first reason assumes that *Podocarpus latifolius* Forest was a single dominant community (or nearly so) until exploited. In 1889 Fourcade (l.c., p. 21) estimated that *P. latifolius* comprised more than 50 per cent of the tree population of Natal forests. The percentage is very much lower to-day: in the Indumeni Forest it is 23·33 per cent (see p. 53). The present abundance of *P. latifolius* saplings and young trees in the shrub layer of protected forests (see p. 53 for figures) suggests the possibility of single dominance.

Measurements were made of illumination in the undergrowth of the Masongwaan Forest using an Evans photo-electric photometer. Readings were taken 4 ft (1·2 m) above the ground at regular intervals along a line

transect, thus including values for shade, sun-flecks and open glades. Expressed as a percentage of full sunlight, minimum illumination was 0·17 per cent, maximum 40·0 per cent and average 2·56 per cent.

The description of *Podocarpus latifolius* Forest which follows is a general one based on all the forests examined. Quantitative data obtained from a detailed analysis of a single stand, the Indumeni Forest, will be presented later.

5.2.1.2.2. *General Description*

(A) Margin

The Forest Precursor Associes which has already been mentioned, constitutes the forest margin. It consists of trees 10–30 ft (3–9·1 m) high, the dominants being *Rhus dentata, R. tomentosa, Euclea lanceolata, Olinia emarginata, Rapanea melanophloeos, Halleria lucida, Rhamnus prinoides* and *Pittosporum viridiflorum.*

Characteristic of the margin are two showy herbaceous climbers, namely *Senecio deltoideus* and *S. tamoides.* Less showy climbers are *Rhoicissus cuneifolius, Clematis brachiata, Dioscorea sylvatica, Asparagus asparagoides, Dumasia villosa* and *Riocreuxia torulosa.*

The margin of *Podocarpus latifolius* Forest is seldom pure. Thus constituents of the Forest Precursor Associes are invariably mixed with *Leucosidea sericea, Buddleia salviifolia* or plants belonging to the Short Shrub Associes. The mixed character of forest margins may indicate either that succession is active or that disturbance has taken place. Disturbance is usually the cause, particularly disturbance by fire.

(B) Forest proper

Podocarpus latifolius Forest is stratified, but the layers are not always well-defined. Several synusiae may be distinguished. They are as follows:—

(*a*) Dominant Tree Layer
(*b*) Small Tree Layer
(*c*) Shrub Layer
(*d*) Field Layer
(*e*) Ground Layer
(*f*) Boulder Communities
(*g*) Epiphytes
(*h*) Climbers
(*i*) Stragglers

(*a*) *Dominant Tree Layer*

Trees of this layer, 40–70 ft (12·2–21·3 m) high, form a discontinuous canopy to the forest. In parts the taller trees appear as emergents above the general tree level. The height of this layer is considerably less than that of forests in the Midlands of Natal.

Associated with *Podocarpus latifolius* are the following trees arranged more or less in order of abundance:—

Scolopia mundtii
Pterocelastrus galpinii
P. sp. (1730)
Curtisia dentata
Celtis africana
Ilex mitis
Rapanea melanophloeos
Kiggelaria africana
Calodendrum capense
Allophylus melanocarpus
Trimera grandiflora
Maytenus peduncularis
Halleria lucida
Cussonia spicata
Apodytes dimidiata
Ekebergia meyeri
Bowkeria verticillata
Podocarpus henkelii
P. falcatus
Ocotea bullata

Podocarpus henkelii and *P. falcatus* were thought to be absent in the Cathedral Peak area: they were not recorded there by Schelpe (1946). However, both species occur in the Indumeni Forest—several adult trees and saplings of *P. henkelii* and only saplings of *P. falcatus*. Another very rare tree is *Ocotea bullata* (Stinkwood), a valuable timber tree. Schelpe (his number 1005) records it for the Umhlonhlo Forest. Together with *Podocarpus henkelii* and *P. falcatus* this species was probably selectively cut out.

Cussonia spicata in the Cathedral Peak area seems to be restricted to forest, where it assumes large dimensions. In the Ndedema Gorge Forest there are specimens 40 ft (12·2 m) tall with a diameter of 3 ft (0·9 m). Elsewhere in Natal *Cussonia spicata* usually grows in savanna. Schelpe (1946, p. 159) misidentified the forest *Cussonia* as *C. paniculata*.

Of the trees mentioned in this layer *Ilex mitis*, *Bowkeria verticillata* and *Halleria lucida* are hygrophilous occurring mainly along streams running through forest.

Buttress-formation is rare and never well-marked. It is exhibited by *Scolopia mundtii*, *Calodendrum capense* and *Ilex mitis*. Most of the trees are evergreen, exceptions being *Celtis africana* and *Trimeria grandiflora*.

(*b*) *Small Tree Layer*

This is a distinct layer about 15–20 ft (4·6–6·1) high. *Diospyros whyteana* (Plate 16) is usually dominant, but occasionally it forms an association with *Maytenus undatus*. Subordinate trees are *Clausena anisata*, *Burchellia bubalina*, *Canthium pauciflorum* and occasionally *Buddleia salviifolia*.

(*c*) *Shrub Layer*

Plants making up this layer range up to 10 ft (3 m) high. There is generally an absence of dominance except in immature *Podocarpus latifolius* Forest where *Myrsine africana* is sometimes dominant. The following shrubs arranged in order of importance comprise this layer: *Carissa bispinosa*, *Canthium ciliatum*, *Cassinopsis ilicifolia*, *Maytenus mossambicensis* var. *mossambicensis*, *Pavetta cooperi* and *Scutia myrtina*. Occasionally *Greyia sutherlandii* and *Dais cotinifolia* occur in the centre of forest usually as relics of earlier stages in the succession to forest.

(*d*) *Field Layer*

The field layer of *Podocarpus latifolius* Forest is luxuriant, but possibly not as luxuriant as that of midland and coast forests. Numerous herbs form societies differing in size, usually pure but sometimes mixed in varying proportions over a wide range of habitat conditions. The exact ecological requirements of each society are inadequately known. Most of the herbs flower between November and the end of March. For the remaining months when some of the herbs die down, the forest floor has an open and scraggy appearance.

Oplismenus hirtellus, a subprostrate grass, forms large societies in very dense shade. *Begonia sutherlandii* with orange flowers occurs in semi-open glades frequently on moist sloping banks. *Streptocarpus gardenii* favours a similar habitat. Common in the Ndedema Gorge Forest, but apparently absent in other forests in the Cathedral Peak area, is *Isoglossa eckloniana*. This acanthaceous herb, about 2 ft 6 in (76·2 cm) high, forms dense societies in open glades and is invariably closely cropped by bushbuck. *Dietes*

vegeta, scattered fairly uniformly through the field layer, is common to most forests in the Drakensberg area, likewise *Stipa dregeana*, *Adenocline mercurialis*, *Plectranthus grallatus*, *Conostomium natalense* and *Schoeonxiphium sparteum*. Other social herbs are *Liparis bowkeri* (usually near forest margins), *Plectranthus dolichopodus*, *Impatiens dutheiae*, *Flemya mitis*, *Disperis fanninae*, *Lobelia patula*, *Galium rotundifolium* and *Huttonaea pulchra*. A succulent which forms very local societies in forest is *Aloe aristata*.

Herbs which do not consistently aggregate to form clearly recognizable societies include *Thalictrum rhynchocarpum*, *Desmondium repandum*, *Sanicula europaea*, *Hypoestes triflora*, *Achyranthes argentea*, *Stachys caffra*, *Pseudobromus africanus*, *Holothrix orthoceros*, *Disperis thorncroftii*, *Physalis peruviana*, *Chironia peglerae*, *Schistostephium hippaefolium* and Killick 2294 (not flowering—either a species of *Littonia* or *Gloriosa*). The three last-named species are very rare.

Certain herbs are confined to streambanks in forest. Among these are the grasses *Brachypodium flexum* and *Arundinaria tesselata* (Berg Bamboo), both forming extremely dense communities, the latter up to 5 ft (1·5 m) high. Three species of *Carex* occur in this habitat, namely *C. spicato-paniculata*, *C. cernua* and *C. zuluensis*.

Ferns are an important constituent of the field layer. Probably the three commonest ferns in *Podocarpus latifolius* Forest are *Pteris quadriaurita*, *Polystichum* sp. (981) and *Blechnum attenuatum* which is conspicuous on the flats adjacent streams. Less frequent are *Adiantum poiretti*, *Polystichum luctuosum*, *Asplenium monanthes*, *A. cuneatum*, *Cheilanthes hirta* var. *laxa*, *Dryopteris pentheri*, *Pteris cretica*, *Lycopodium saururus* and *Cystopteris fragilis*.

(*e*) *Ground Layer*

The ground layer is discontinuous and occurs only where the floor is moist and where there is little surface litter of leaves. It consists almost entirely of bryophytes. Schelpe (1953, pp. 87–88) records the following species:—

Eulejeunea capensis	*Eulejeunea capensis*
Madotheca capensis	*Arthoceros natalensis*
Lophocolea molleri	*Catharinea androgyna*
Plagiochila natalensis	*Fissidens glaucescens*
Bryum truncorum	*Bartramia hampeana*
B. capillare	*Eustichia longirostis*
Porothamnium natalense	*Mnium rostratum*
Hypnum sp.	*Rhodobryum umbraculum*
Hypopterygium laricinum	*Funaria hygrometrica*
Archilejeunea chrysophylla	

Earthbanks along streams support mainly thallose hepatics. These include *Marchantia wilmsii Fimbraria bachmannii*, *Plagiochasma rupestre* and *Anthoceros natalensis* (Schelpe, l.c.).

Hidden under the moss layer and under dead leaves are numerous saprophytic fungi. These have not yet been studied.

(*f*) *Boulder Communities*

Scattered throughout Drakensberg forests are boulders or blocks of Cave Sandstone of varying size. These boulders are usually moist and support their own characteristic plant populations.

The first plants to colonize the boulders are lichens and bryophytes. One of the commonest lichens is Killick 1391, a grey foliose lichen of large diameter. Schelpe (1953, p. 88) lists the following mosses for scattered boulders:—

Archilejeunea sp.	*Mnium rostratum*
Ptycanthus striatus	*Fabronia abyssinica*
Madotheca capensis	*Brachythecium subrutabulum*
Radula boryana	*Porothamnium natalense*
Tortula brevimucronata	*Entodon dregeanus*
Macromitrium mannii	*Microthamnion* sp.
Schotheimia rufoaeruginosa	*Hypopterygium laricinum*
Bryum truncorum	*Rhacopilum capense*

Boulders along streambanks in forest have a different bryophyte flora. According to Schelpe the most conspicuous moss in this habitat is *Fissidens glaucescens*, while less conspicuous are:—

Plagiochasma rupestre	*Anthoceros natalensis*
Fimbraria bachmannii	*Fissidens amblyophyllus*
Marchantia wilmsii	*Bryum alpinum*
Frullania sp.	*B. aulacomnoides*
Chiloscyphus sp.	var. *limbatum*
Lophocolea molleri	*B. truncorum*
Plagiochila natalensis	*Brachythecium subrutabulum*

The moss mats are invaded by a variety of vascular plants. *Stenoglottis fimbriata*, *Crassula filamentosa*, *C. umbraticola*, *Peperomia reflexa*, *Streptocarpus gardenii*, *S. pusillus* and the fern *Elaphoglossum petiolatum* form small colonies not more than 4–5 in (10·2–12·7 cm) high. *Vellozia talbotii* occurs in dense societies on the vertical faces of boulders adjacent streams. A versatile species occurring in forest as well as in the open at 7,000–9,000 ft (2,133–2,743 m) is *Eucomis bicolor*. It is occasional in forest. *Aloe arborescens* occurs on large boulders in open glades. This *Aloe* is not a true forest plant: it probably originates from the Cave Sandstone cliffs adjacent and above forest. Ferns occasional to frequent are *Lycopodium verticillatum*, *Asplenium cuneatum*, *Polypodium schraderi*, *P. lanceolatum* and *Elaphoglossum angustatum*.

(*g*) *Epiphytes*

The epiphytic population consists mainly of lichens and bryophytes. Schelpe (1953, p. 88) states that bryophytes are not abundant—possibly not in number of species, but certainly in number of individuals. Schelpe distinguishes between low and high level epiphytic mosses. In the former category he lists *Madotheca capensis*, *Pleuropus sericeus*, *Metzgeria furcata*, *Frullania ecklonii*, *F.* sp. aff. *F. trinervis* and *Macromitrium tenue*, and in the latter are *Frullania natalensis*, *Madotheca capensis*, *Bryum truncorum* and *Brachyhymenium pulchrum*. One of the most conspicuous bryophytes in *Podocarpus latifolius* Forest is the pendent *Squamidium rehmannii* sometimes 6 ft (1·8 m) long.

Trees in *Podocarpus latifolius* Forest especially the emergents and those near the margin are frequently festooned with a species of *Usnea*, a grey dendroid lichen.

Epiphytic ferns include *Polypodium schraderi*, *P. ecklonii*, *P. vulgare*, *Pleopeltis lanceolata*, *Asplenium rutaefolium* and the delicate hymenophyllaceous *Trichomanes melanotrichum*.

The only angiosperm epiphytes are *Peperomia reflexa* and the orchid, *Polystachya ottoniana*.

(*h*) *Climbers*

Climbers are fairly frequent and help knit together a rather open canopy. Woody climbers are represented by *Secamone alpinii*, *Rhoicissus revoilii* and *R. cuneifolius*. The first two have stems up to 4 in (10·2 cm) in diameter and climb to the tops of the tallest trees. *Rhoicissus cuneifolius*, of much smaller proportions, is restricted to the edge of forest. Herbaceous climbers include *Tylophora flanaganii*, *Senecio tamoides*, *S. deltoideus*, *Dioscorea sylvatica* and *Dumasia villosa*. *Tylophora flanaganii* and *Senecio tamoides* occur in the centre of forest, but the rest are marginal or near-marginal.

(*i*) *Stragglers*

Under this heading are included woody plants which straggle in a diffuse manner and are sometimes semi-scandent. The stragglers are *Scutia myrtina*, *Rubus pinnatus*, *Buddleia auriculata* var. *euryfolia* and *Cassine tetragona* var. *laxa*.

Miscellaneous Observations

1. *Variation in Composition of Drakensberg Forests*

On the whole the forests are fairly uniform in composition. Probably the most atypical is the Ndedema Gorge Forest. This forest is not as accessible as most forests in the Drakensberg and there is little evidence of exploitation. The only footpaths present are game-tracks. Unlike most other forests in the Drakensberg, the Ndedema Gorge Forest apparently contains no *Pterocelastrus* [neither *P. galpinii* nor *P.* sp. nov. (1730)] and unlike most forests in the Cathedral Peak area it contains *Cassine tetragona* var. *laxa*, *Pavetta cooperi* and *Dais cotinifolia*, species which are characteristic of forests further south in the Cathkin Peak area.

2. *Mortality of Tree Seedlings*

Mortality of tree seedlings in *Podocarpus latifolius* Forest is high. In December, 1952, the floor of the Masongwaan Forest was covered with numerous seedlings of *Diospyros whyteana*. In March, 1953, there were scarcely any seedlings to be seen. Five years later, in 1957, the same phenomenon was noticed, but this time with *Ilex mitis*. Several seedlings were examined and fungal myceliae were discovered at the roots. It may be that a fungus was the cause of the seedling mortality, but this requires investigation. The factor or factors causing seedling mortality is an important aspect of forest ecology, one deserving more attention from ecologists.

5.2.1.2.3. *Analysis of the Indumeni Forest*

The Indumeni Forest was selected as fairly representative of *Podocarpus latifolius* Forest in the Cathedral Peak area and was analysed in November, 1953. This forest is situated in a bend of the Indumeni River near its confluence with the Ofandweni River. Of irregular outline it lies below the Cave Sandstone cliffs and covers an area of about 70 acres (28 Ha). See Plate 17.

Very little quantitative work has been done on South African forests. The only work known to the author is that of Phillips (1931) at Knysna and Story (1952) in the Keiskammahoek District. Both Phillips and Story used the belt-transect method—a method which gives a rough and ready evaluation of overall composition, since it samples only a restricted area of the forest.

The four basic problems of vegetation analysis which have to be considered when devising a sampling method are plot shape, size, number and distribution. These problems will be discussed separately.

(*a*) *Shape*

The most commonly used shape in analysis is the square (quadrat). However, it has been demonstrated that a rectangle of equal area is more efficient (Clapham, 1932, pp. 192–197). Clapham found that the variance between rectangular strips was significantly less than between squares. He states that " a quadrat may lie wholly in one small section of the floristic pattern, while a strip will more probably sample all sections ".

The rectangular strip or plot has other advantages as well. It is easier to place in dense vegetation (Pidgeon & Ashby, 1940, p. 127), it can be subdivided more readily for counting and one can avoid trampling on one part of the sample area while examining the other (Clapham, l.c., p. 197).

The chief disadvantage of the rectangle is that as it narrows the proportion of perimeter to area increases and hence the effect of edge-errors. Edge-errors arise from the difficulty of deciding whether a plant does or does not fall within the sample.

(*b*) *Size*

The problem of plot size has engaged the attention of ecologists ever since Raunkiaer's time. The relevant literature is vast and need not be reviewed here. Agreement has been reached on several aspects of the problem. Briefly they are as follows:—

(i) The multiple-plot method of analysis, where a considerable number of small plots is used, is preferable to the single-plot method, where one large plot is used. The former method obviates the possibility of sampling an atypical area and provides a measure of the variability among samples.

(ii) The size of the plot should be adjusted to the size of the predominant life form in the community being investigated. Trees and shrubs will clearly require larger plots than herbs.

(iii) Plots should be of such a size that most plants have a frequency of less than about 80 per cent (Ashby, 1935 and Curtis & McIntosh, 1950). According to Curtis & McIntosh (l.c., p. 425) if the values are higher " the shape of the interrelation curves is such that minimum accuracy will obtain in the prediction

of the magnitude of other characters such as density, abundance, constancy and presence ". These authors recommend a plot size equal to twice the mean area (the reciprocal of density) of the most common species.

(iv) The plot should not be so small that perimeter per unit area becomes too great, otherwise edge-effects which have already been referred to when considering shape become significant.

Various sized plots have been used and recommended in forest analysis. Cain (1932, p. 488) suggested the following sizes: field layer 1–2 sq m, shrub layer 4 sq m and tree layer 16–100 sq m. Oosting (1942, p. 4), working in Piedmont, U.S.A., used the following sizes for the three strata: 2×2, 4×4 and 10×10 m. He derived his sizes from species-area curves, a procedure which is open to criticism. Curtis & McIntosh (1950, p. 453) recommend the same sizes as used by Oosting. They maintain that such sizes would give frequencies less than 80 per cent for the eastern deciduous forests of North America.

The optimum size plot for each layer can only be determined by preliminary analysis. For such an analysis it was felt that a 100 sq m plot would be adequate for all three layers.

(*c*) *Number*

It is possible to compute, for whatever character is being investigated, the number of plots required to give a mean value within a given percentage of the true mean on a probability of 0·05. The formula as given by Snedecor (1950, p. 458) is as follows:—

$$n = \frac{tC^2}{p}$$

where n = number of quadrats required,
t = statistical " t " from tables,
C = coefficient of variation,
and p = percentage accuracy required.

It is necessary to decide which species should serve as criteria of a plant community on which to base estimates of sampling intensity. The alternatives are all plants, each individual species, the dominant species, or two or more of the most important species or the secondary species. It would be impractical to sample adequately for each individual species and secondary species, since these characters are usually highly variable and the more variable the character the greater the number of plots required. Rycroft (1951) working at Jonkershoek, in the Cape Province, used all plants i.e. total plant density, and determined the number of plots necessary to sample fynbos vegetation at levels of 5 and 10 per cent accuracy. It would seem that the most satisfactory criteria are all plants, dominant species and the more important species.

(*d*) *Distribution*

One of the main essentials of analysis is to distribute the samples at random. This allows for statistical tests of reliability. However, completely free random sampling tends to leave large areas unsampled with maximum concentration in only a few areas. The ecologist usually prefers a more uniform distribution of his plots. One way of achieving this is by stratifying the plots i.e. the community is divided up into blocks and the plots are distributed at random therein. Snedecor (1950, p. 73) maintains that

stratification does not involve a desertion of the fundamental principle of randomness: all individuals are still afforded equal chance of being included in the sample.

Method

The sampling unit used in the Indumeni Forest was a rectangular plot 100 sq m (5 × 20 m) in area. The plots were laid in the following manner. A length of thick twine was marked off with red tape at intervals corresponding to the sides of the plot. A steel marker was inserted into the ground at one end of the twine and then another at the 20 m mark. A right angle was estimated visually and another marker placed at a distance of 5 m. This procedure was repeated until the plot was completed.

The forest was divided up into 10 more or less equal blocks and two plots were randomly distributed (random numbers in different directions) within each block making a total of 20 plots.

The number of individuals of each species in each stratum (dominant, small tree layer and shrub) was counted and recorded separately. From the data obtained, values were calculated for relative density (percentage composition), density and frequency. These characters are used in the sense of Curtis & McIntosh (1950, pp. 435–437), who defined them as follows:—

$$\text{Relative Density} = \frac{\text{Number of individuals of a species}}{\text{Total number of individuals of all species}} \times 100$$

$$\text{Density} \ldots\ldots\ldots = \frac{\text{Total number of individuals of a species found}}{\text{Total number of plots examined}}$$

$$\text{Frequency} \ldots\ldots = \frac{\text{Number of plots in which a species occurs}}{\text{Total number of plots examined}} \times 100$$

The results are given in Table 6.

Discussion and Application of Results

(*a*) *Composition*

In the dominant tree layer *Podocarpus latifolius* is clearly dominant: it has a relative density (23·33 per cent) almost twice that of the next abundant species, *Pterocelastrus* sp. nov. (1730) (13·33 per cent). No less than 74·17 per cent of the plant population is provided by 7 of the 19 species recorded, namely *Podocarpus latifolius*, *Pterocelastrus* sp. nov. (1730), *P. galpinii*, *Rapanea melanophloeos*, *Curtisia dentata*, *Celtis africana* and *Scolopia mundtii.*

In the small tree layer *Diospyros whyteana* is dominant having a relative density nearly four times that of the next species *Clausena anisata*. Here 68·92 per cent of the plant population is provided by 5 of the 22 species recorded.

The striking feature of the shrub layer is the high relative density of the transgressives, i.e. saplings of trees belonging to higher layers. Transgressives, which comprise 20 of the 25 species listed in the shrub layer, contribute 93·10 per cent. The high density of *Podocarpus latifolius* in the shrub layer (15·95 plants per plot) as compared with the dominant tree layer (1·40 plants per plot) gives quantitative support to the suggestion

TABLE 6.—Analysis of the Indumeni Forest. Values for relative density, density and frequency

Dominant Tree Layer				Small Tree Layer				Shrub Layer			
Species	R.D.	D.	F.	Species	R.D.	D.	F.	Species	R.D.	D.	F.
Podocarpus latifolius	23·33	1·40	45	*Diospyros whyteana*	37·86	1·95	75	*Podocarpus latifolius*	42·82	15·95	95
Pterocelastrus sp. nov.	13·33	0·80	35	*Clausena anisata*	9·71	0·50	35	*Diospyros whyteana*	29·13	10·85	95
P. galpinii	9·17	0·55	35	*Canthium pauciflorum*	7·77	0·40	15	*Carissa bispinosa*	4·77	1·75	80
Rapanea melanophloeos	8·33	0·50	20	*Halleria lucida*	6·79	0·35	30	*Scolopia mundtii*	4·43	1·65	50
Celtis africana	6·67	0·40	35	*Podocarpus latifolius*	6·79	0·35	25	*Canthium ciliatum*	3·22	1·20	50
Curtisia dentata	6·67	0·40	25	*Rapanea melanophloeos*	3·88	0·20	15	*Clausena anisata*	3·09	1·15	65
Scolopia mundtii	6·67	0·40	20	*Allophylus melanocarpus*	2·91	0·15	15	*Pterocelastrus galpinii*	2·01	0·75	35
Ilex mitis	3·33	0·20	20	*Kiggelaria africana*	2·91	0·15	15	*Maytenus peduncularis*	1·75	0·65	40
Clausena anisata	3·33	0·20	15	*Maytenus peduncularis.*	2·91	0·15	10	*M. undatus*	1·07	0·40	25
Cussonia spicata	3·33	0·20	10	*Apodytes dimidiata*	1·94	0·10	10	*Canthium pauciflorum*	0·94	0·35	35
Kiggelaria africana	3·33	0·20	10	*Canthium ciliatum*	1·94	0·10	10	*Scutia myrtina*	0·94	0·35	20
Trimeria grandiflora	2·50	0·15	5	*Ilex mitis*	1·94	0·10	10	*Burchellia bubalina*	0·81	0·30	30
Allophylus melanocarpus	1·67	0·15	15	*Pterocelastrus galpinii.*	1·94	0·10	10	*Pterocelastrus* sp. nov	0·81	0·30	25
Apodytes dimidiata	1·67	0·10	10	*P.* sp. nov.	1·94	0·10	10	*Trimeria grandiflora*	0·81	0·30	20
Maytenus peduncularis	1·67	0·10	10	*Trimeria grandiflora*	1·94	0·10	10	*Curtisia dentata*	0·67	0·25	20
Halleria lucida	1·67	0·10	10	*Buddleia salviifolia*	0·97	0·05	5	*Celtis africana*	0·54	0·20	20
Calodendrum capense	0·83	0·05	5	*Burchellia bubalina*	0·97	0·05	5	*Podocarpus henkelii*	0·54	0·20	5
Podocarpus henkelii	0·83	0·05	5	*Cassinopsis ilicifolia*	0·97	0·05	5	*Allophylus melanocarpus.*	0·40	0·15	10
Royena lucida	0·83	0·05	5	*Celtis africana*	0·97	0·05	5	*Olinia emarginata*	0·27	0·10	10
				Curtisia dentata	0·97	0·05	5	*Rinorea natalensis*	0·27	0·10	10
				Cussonia spicata	0·97	0·05	5	*Halleria lucida*	0·27	0·10	5
				Rhus dentata	0·97	0·05	5	*Apodytes dimidiata*	0·13	0·05	5
								Maytenus mossambicensis	0·13	0·05	5
								Rapanea melanophloeos	0·13	0·05	5
								Maytenus acuminatus	0·13	0·05	5

on p. 45 that *Podocarpus latifolius* Forest is potentially a single dominant forest. It is appreciated of course that because of competition and other factors not all the saplings will attain maturity.

(*b*) *Plot Size*

From results obtained it is possible, following Curtis & McIntosh (1950, p. 453), to determine the optimum size plot required for each layer. The optimum size will be equal to twice the mean area $\left(\frac{1}{D}\right.$, where D equals the number of individuals per total area sampled) of the most abundant species.

In the dominant tree layer *Podocarpus latifolius* is the most abundant species; it has a mean area of 2000/28, hence the optimum size is 142·85 sq m. This size would probably give frequency values in the desired range i.e. the abundant species less than 80 per cent, with most species less than 20 per cent. The frequency values obtained with the 100 sq m plot used are considerably lower than optimum.

In the small tree layer *Diospyros whyteana* is the most abundant species: it has a mean area of 2000/39 and hence optimum size is 102·56 sq m, which is slightly larger than the area used in the analysis. Frequency values obtained with the 100 sq m plot are almost optimum.

In the shrub layer *Podocarpus latifolius* is the most abundant species with a mean area of 2000/319 and hence optimum size is 12·23 sq m. The frequency values obtained with the 100 sq m plot are considerably higher than optimum, consequently drastic reduction in plot size is obviously required.

To sum up, the optimum sizes for the different layers are as follows:—

(1) Dominant tree layer....................	142·85 sq m
(2) Small tree layer........................	102·56 sq m
(3) Shrub layer...........................	12·23 sq m

(*c*) *Plot Number*

Sampling intensity can be determined in the manner described on p. 52. It is best based on data for density, since density is the only absolute measure of quantity obtained in the analysis. The criteria which will be used here are all plants, the dominant species and the more abundant species (here taken as species with a relative density of over 4 per cent). The number of 100 sq m plots required to sample each layer at 5, 10 and 20 per cent levels of accuracy is given in Table 7.

The level of accuracy accepted in any analysis will depend upon the object of the analysis. If the object is to study plant succession and the area is to be resampled at some later stage, or if variation within the community is being investigated, then a high degree of accuracy is required. Accuracy of 5 per cent is desirable, but the intensity (2892, 1172 and 1096 plots for the dominants *Podocarpus latifolius*, *Diospyros whyteana* and *Podocarpus latifolius* in the three layers respectively) is a practical impossibility. Even 10 per cent is inordinately high. For sampling overall composition 20 per cent is probably quite satisfactory. One hundred and eighty-one 100 sq m plots i.e. 0·06 per cent of the total area of the forest, would sample adequately all three layers, whichever of the three community criteria is used.

TABLE 7.—Number of 100 sq m plots required for 5, 10 and 20 per cent accuracy

Community-criteria	Dominant Tree Layer			Small Tree Layer			Shrub Layer		
	5%	10%	20%	5%	10%	20%	5%	10%	20%
All plants	868	217	54	316	79	20	532	133	33
Dominant species	2,892	723	181	1,172	293	73	1,096	274	69
More important species	1,392	348	87	680	170	43	624	156	44

(d) Species Dispersion

Whitford (1949, p. 202) has proposed the ratio of abundance to frequency as a measure of contagion i.e. $K = \frac{A}{F}$, where K is the relative dispersion. Abundance is related to both density and frequency, the relationship being $A \times F = 100D$. The same density may be produced by high frequency and low abundance (regular distribution) or low frequency and high abundance (contagious distribution). Substituting for A in Whitford's formula:—

$$K = \frac{100D}{F^2}$$

This measure of dispersion has two disadvantages. The first is that it is not an absolute measure and the second is that it can only be applied to species with a frequency of 20 per cent or over (Curtis & McIntosh, 1950, p. 448).

Since both density and frequency were determined in the analysis of the Indumeni Forest, Whitford's formula can be used to compare the dispersion of major species in the two tree strata with their dispersion in the shrub layer where they are transgressives. Values for K for species with frequency greater than 20 per cent are given in Table 8.

TABLE 8.—Relative dispersion of major species according to Whitford's $\frac{A}{F}$ ratio

Species	Tree Layers (Dominant and Small)	Shrub Layer
Podocarpus latifolius	0·0691	0·1768
Pterocelastrus sp. nov. (1730)	0·0653	0·0480
P. galpinii	0·4490	0·0612
Celtis africana	0·0317	0·0500
Curtisia dentata	0·0640	0·0625
Scolopia mundtii	0·1000	0·0660
Diospyros whyteana	0·0347	0·1201
Clausena anisata	0·0408	0·0272

The results show that the dominants of the dominant tree layer and the small tree layer, *Podocarpus latifolius* and *Diospyros whyteana* respectively, are about three times more contagious as transgressives than they are as adult trees. With the exception of *Celtis africana* and *Clausena anisata*, the remaining trees are more contagious in the adult stage i.e. the situation is reversed. From purely superficial observations it is obvious that *Podocarpus latifolius* and *Diospyros whyteana* are contagiously distributed in their early stages: saplings of these species occur in frequent clumps in *Podocarpus latifolius* Forest.

5.2.2. *The Subseres*

The building of the mountain road onto the Little Berg has produced areas where secondary succession can be studied. One result of blasting operations has been the formation of scree-like rock rubble below the

road. In September, 1950, when the author started the present survey these areas were densely covered by *Helichrysum tenax*, a shrubby composite which is normally found on streambanks and in fynbos where it is rare to occasional. Also present were *Aristida galpinii*, *Rhynchelytrum setifolium*, *Chrysocoma tenuifolia*, *Metalasia muricata*, *Helichrysum setosum*, *Stoebe vulgaris*, *Halleria lucida*, *Solanum giganteum* and *Phytolacca* sp. (3437). To-day the vegetation consists chiefly of *Buddleia salviifolia* and *Hyparrhenia hirta* with little left of *Helichrysum tenax*, the original pioneer. *Helichrysum tenax* also invaded parts of the grassland below the road, which were covered with a sparse litter of rock rubble.

Roadsides in the Montane Belt are colonized by *Cynodon hirsutus* var. *parviglumis*, *Eragrostis plana* and *Hyparrhenia* spp.

On 5 January, 1958, during a particularly heavy storm several large blocks of stone broke away from the Cave Sandstone cliffs and rolled through the marginal scrub (Short Shrub Associes and Bracken Veld) of the Indumeni Forest into the Indumeni River. The bare area produced has since been colonized by the ruderal *Erigeron canadensis*. Before the fall of rock there were no signs of *E. canadensis* in the Indumeni Forest area.

Chapter 6

THE SUBALPINE BELT

6.1. Introduction

The Subalpine Belt extends from the edge of the Little Berg to just below the summit of the Drakensberg i.e. from 6,000–9,400 ft (2,865–3,353 m). The vegetation of this belt also occurs in a modified form on outlying plateaux such as Tabamhlope near Estcourt.

As in the Montane Belt the vegetation consists mainly of tussock grassland, chiefly *Themeda triandra* Grassland. Also present are Temperate Grasslands occurring on mesocline slopes, Tall Grassland, *Rendlia altera* Grassland and the *Danthonia macowanii* Consocies. Woody communities include *Cliffortia linearifolia* Scrub, *Leucosidea sericea* Scrub, *Buddleia salviifolia* Scrub, *Protea* Savanna (very limited in extent) and the climax community of the Subalpine Belt, *Passerina–Philippia–Widdringtonia* Fynbos. Ecotonal areas are present at the upper and lower limits of this belt.

6.2. Plant Succession

6.2.1. *The Priseres*

The suggested interrelationships of the plant communities in the hydrosere and lithosere are given in Fig. 8.

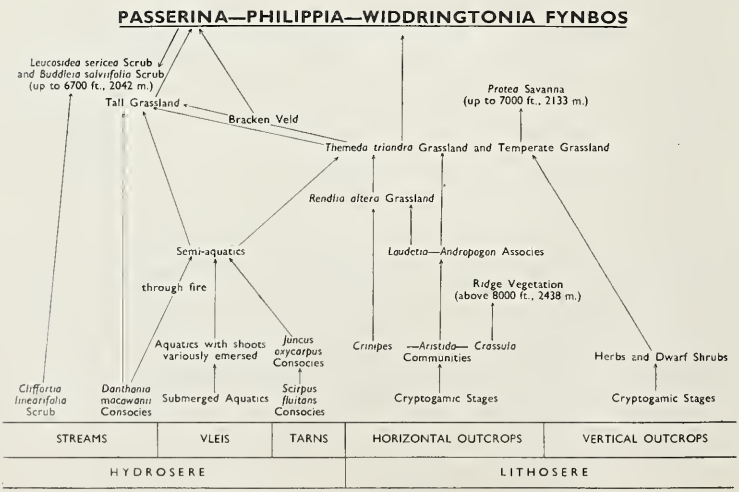

Fig. 8.—Suggested interrelationships of the plant communities in the hydrosere in the Subalpine Belt

6.2.1.1. *Seral Stages*

6.2.1.1.1. *The Hydrosere*

As in the Montane Belt primary hydroseral areas are neither abundant nor extensive. They can be classified into four main categories. Firstly, there are the streams draining the catchments on the Little Berg. These streams have narrow channels, variously sloped banks and are swift-flowing. The streams are broken at intervals by waterfalls. Secondly, there are the rivers lying between the spurs of the Little Berg. The rivers and their vegetation have already been described (pp. 29–33). Thirdly, there are the vleis situated near the edge of the Little Berg at about 6,000 ft (1,829 m), where the catchments are more or less level and the soil lies shallowly over the basalt. Fourthly, there are the very rare tarns present on the ridges of spurs. The only permanent tarn in the Cathedral Peak area is the Mushroom Tarn situated at 6,200 ft (1,890 m) on Mushroom Ridge.

The respective seres initiated in the above areas, with the exception of rivers, will be discussed in turn.

(A) Vleis

A typical vlei on the Little Berg has the following structure. The main stream or streams traversing a vlei keep either to a single channel or divide up into innumerable small channels which periodically alter their course. On level ground adjacent to the channels are lenticular areas consisting of raised hummocks surrounded by hollows containing a few inches of usually stagnant water. On sloping ground where drainage is better the vlei has an even surface and the soil is firm but moist. Here and there are horizontal basalt outcrops which, depending upon their slope, support shallow pools containing either stagnant or running water.

The sequence of stages in the vlei succession is as follows:—

(*a*) *Submerged Aquatics*

The only regularly submerged aquatics are green filamentous algae and a moss, *Philonotis laeviuscula*, which forms a loose matrix in stagnant pools. The moss *Philonotis afrofontana* is also sometimes submerged, but invariably in running water. It produces small cushions.

(*b*) *Aquatics with Shoots slightly to almost Completely Emersed*

Plants of this stage can be divided into dwarf and tall aquatics, the former occurring in pools with a thin mud substratum and the latter in pools with a deep substratum.

The dwarf aquatics are found chiefly in pools on basalt outcrops. Several species form consocies. Very characteristic of this stage is *Anagallis huttonii* belonging to the Primulaceae. This plant has creeping stems up to 2 ft (60·96 cm) long (Plate 18). It also forms communities in pools between hummocks. Another important plant in this stage is *Limosella maior*. About 2 in (5 cm) high, this aquatic produces an intricate network of stolons which in running water holds up a considerable amount of silt. Other plants forming consocies are *Scirpus hystrix*, *Bulbostylis densa*, *Juncus dregeanus*, *Eriocaulon abyssinicum* and *E. dregei*, all between 2–6 in (5–15·2 cm) high. Dwarf aquatics which do not aggregate to any great extent are *Pycreus rehmannianus*, *Xyris capensis*, *Rhodohypoxis palustris*, *Senecio erubescens* and *Athrixia fontana*. The three last-named species are found in running water, frequently among small stones.

The taller aquatics include *Scirpus macer*, *Carex cernua*, *Eleocharis palustris*, *Rhynochospora brownii*, *Juncus exertus*, *J. rostratus*, *Arundinaria nepalensis*, *Anoiganthus breviflorus*, *Gunnera perpensa* and *Epilobium hirsutum*. All these plants form consocies and sometimes associes. A combination which is very common on the Little Berg is the *Scirpus–Dryopteris–Anoiganthus–Gunnera* Associes. When not occurring in shallow water these aquatics are to be found on exceedingly boggy soil.

(*c*) *Semi-aquatics*

The semi-aquatic stage comprises a large number of species growing on moist soil. The most important species are *Pycreus oakfortensis*, *Rhynchospora brownii*, *Fuirena pubescens*, *Scleria welwitschii*, *S. woodii* and the grass *Stiburus alopecuroides*. *S. alopecuroides* frequently forms conspicuous associes with the tussock-forming *Pyreus oakfortensis*—also sometimes with *Scleria woodii*.

Less prominent are the following species. Among the sedges are *Scirpus ficinioides* which is common on the summit of the Drakensberg, *Bulbostylis schoenoides*, *Kyllinga erecta*, *Ascolepis capensis*, *Pycreus* sp. (1369) and *Mariscus congestus*. Grasses include *Pennisetum thunbergii*, *Agrostis huttonii* *Stiburus conrathii*, *Andropogon eucomus* and *Bromus speciosus*. Orchids do not appear to be such a characteristic element of vleis on the Little Berg as they are of vleis at lower altitudes in Natal. The only species observed were *Eulophia* sp. (1157), *Neobolusia tysonii*, *Habenaria orangana* and *Satyrium longicauda*. Other monocotyledons are *Aristea angolensis*, *Gladiolus psittacinus*, *Tulbaghia alliacea* and *Moraea culmea*. Composites include *Nidorella polycephala*, *Helichrysum mundtii*, *H. umbraculigerum*, *Denekia capensis*, *Conyza podocephala*, *Hieracium capense*, *Senecio serratuloides*, *S. brevidentatus*, *Gerbera natalensis* and *Lactuca capensis*. Other families are represented by *Rumex woodii*, *Mimulus gracilis*, *Melasma scabra*, *Alectra* sp. (1498), *Hypericum lalandii*, *Swertia welwitschii*, *Chironia krebsii*, *C. peglerae*, *Sebaea repens*, *Geranium pulchrum*, *Drosera natalensis* (often on the sides of hummocks), *Veronica anagallis-aquatica*, *Lobelia flaccida* var., *L. decipiens*, *Pycnostachys reticulata* and *Erica alopecurus*.

At the edge of vleis where conditions are drier, the following species may be found:—

Ophioglossum reticulatum	*Linum thunbergii*
Andropogon appendiculatus	*Ajuga ophrydis*
Poa binata	*Alepidea setifera*
Helictotrichum turgidulum	*Anthospermum hedyotideum*
Harpechloa falx	*Galium wittbergense*
Eragrostis nebulosa	*Helichrysum aureonitens*
E. curvula	*Senecio harveyanus*
Ranunculus multifidus	*Cirsium vulgare*
Hibiscus trionum	*Gnaphalium undulatum*

(B) Tarns

Mushroom Tarn is about 75 yd (69 m) in diameter. At the periphery there is distinct zonation of aquatic communities. Nearest the centre, in water about 2–3 in (5–7·6 cm) deep, is *Scirpus fluitans*, then *Juncus oxycarpus*, and at the very edge on wet soil are the grasses *Agrostis huttoniae* and *Eragrostis planiculmis*. In parts the Tarn has vertical banks, which are occupied by *Cliffortia linearifolia*.

(C) Streams

As indicated on p. 59 streams on the Little Berg are swift-flowing, consequently there is no true aquatic vegetation. The four major communities fringing streambanks are the *Danthonia macowanii* Consocies, *Cliffortia linearifolia* Scrub, *Leucosidea sericea* Scrub and *Buddleia salviifolia* Scrub. In addition, there is the vegetation of waterfalls.

(*a*) Danthonia macowanii *Consocies*

This consocies is found on approximately level streambanks between 6,000–7,500 ft (1,829–2,286 m). The dominant, *D. macowanii*, is a xeromorphic grass with leaves up to 2 ft 6 in (76 cm) long and culms up to 4 ft (1·2 m) long (Plate 19). It forms very large tussocks some nearly 2 ft (61 cm) in diameter. When in flower during summer the *D. macowanii* Consocies shows up yellow against the green of the surrounding grassland.

Associated species in order of abundance are:—

Geranium pulchrum
G. ornithopodum var. *album*
G. ornithopodum var. *lilacinum*
Mariscus elatior
Galium wittbergense
Gunnera perpensa
Silene capensis
Carex zuluensis
Berkheya macrocephala
Hibiscus trionum
Alepidea amatymbica
Argyrolobium tuberosum
Kniphofia sp. (1431)
Crassula lineolata
Sebaea natalensis
Berkheya speciosa
Helichrysum inerme
H. fulvum
Melothria cordata

On the vertical sides of the stream channels are the following species:—

Mohria caffrorum
Sticherus umbraculiferus
Oxalis obliquifolia
Drosera natalensis
Polygala hispida
Sebaea procumbens
Gnidia baurii
Hypoxis membranacea
Erica alopecurus
Ranunculus cooperi
Anoiganthus breviflorus
Umbellifer (1227)
Helichrysum cooperi
H. fulvum

In addition, there are hepatics and mosses which have not been investigated.

Where stream channels are broad 3–7 ft (0·9–2·1 m), *Cliffortia linearifolia*, a sclerophyllous shrub, 3–4 ft (0·9–1·2 m) high, grows on the vertical sides and meets over the middle of the stream. The absence of *C. linearifolia* along narrow channels suggests that it cannot stand the intense shade cast by the overlapping foliage of *Danthonia macowanii*. *Cliffortia linearifolia* does not seem to compete with or succeed *Danthonia macowanii:* it simply forms a fringe parallel to *D. macowanii*, but closer to the water.

In Catchment 8 on the Research Area there is evidence that the hummocks in the vlei have developed from tussocks of *Danthonia macowanii* which have been killed by burning and then subsequently vegetated by semi-aquatics. All stages in hummock formation are present—from recently burnt tussocks of *D. macowanii* to tussocks living at the periphery but dead in the centre and invaded by *Stiburus alopecuroides*, *Pennisetum thunbergii*, *Bromus speciosus* and *Geranium pulchrum*—to tussocks completely vegetated by semi-aquatics.

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(*b*) Cliffortia linearifolia *Scrub*

This community occurs in deep stream gullies between 6,400–7,400 ft (1,951–2,256 m). *Cliffortia linearifolia* is the dominant shrub and *Philippia evansii* is frequently sub-dominant. The community has an average height of about 4 ft (1·2 m) and varies considerably in its density.

Associated shrubs include *Myrsine africana*, *Anthospermum aethiopicum*, *Royena hirsuta*, *Athanasia punctata*, *Maytenus acuminatus*, *Rhamnus prinoides*, *Phygelius capensis*, *Polemannia montana*, *Erica ebracteata*, *Euphorbia epicyparissias* and *Bowkeria verticillata*.

The most characteristic herbs in order of abundance are:—

Alepidea amatymbica
Cephalaria natalensis
Scabiosa drakensbergensis
Valeriana capensis
Helichrysum hypoleucum
Alchemilla natalensis
Myosotis sylvatica
Printzia pyrifolia
Berkheya multijuga
Geranium pulchrum
Sticherus umbraculiferus
Lysimachia ruhmeriana
Diclis reptans
Senecio haygarthii
Galium wittbergense
Cycnium racemosum
Wahlenbergia undulata

Two climbers are fairly common, namely *Riocreuxia torulosa* var. *tomentosa* and *Asparagus scandens*.

The tree fern, *Cyathea dregei*, occurs in this scrub at varying intervals along streams. It appears to be more frequent further south in the Cathkin Peak area.

Along the margin of *Cliffortia linearifolia* Scrub is *Cymbopogon validus* or *Miscanthidium capense* Grassland to be described later or the *Aristida monticola* Consocies. *Aristida monticola* on streambanks has long, slender, semi-prostrate, densely aggregated culms, which appear as if they have been combed in a downward direction.

Cliffortia linearifolia Scrub can perhaps be classified as a type of fynbos. Several of the constituent species, for example *Philippia evansii* and *Erica ebracteata*, occur in true fynbos, but not the dominant, *Cliffortia linearifolia*. *C. linearifolia* is a hygrophilous species confined almost entirely to streambanks.

(*c*) Leucosidea sericea *Scrub*

Leucosidea sericea Scrub is a montane element which occurs in sheltered situations on the Little Berg up to 6,700 ft (2,042 m). The situations are usually streambanks and deep gullies.

The community results from the invasion of *Cliffortia linearifolia* Scrub (Plate 20) and fynbos by *Leucosidea sericea*. Often, however, *L. sericea* directly invades and forms thickets in Tall Grassland, particularly *Miscanthidium capense* Grassland, Bracken Veld and sometimes *Themeda triandra* Grassland.

Mature, closed stands of *Leucosidea sericea* Scrub are not common on the Little Berg. The best examples on the research area are in Catchments 6 and 9 and in the Tutumi Valley (Plate 21). Mature *Leucosidea sericea* Scrub is dominated by *L. sericea* growing up to 20 ft (6·1 m) high with the following associates: *Buddleia salviifolia*, *Philippia evansii*, *Rhus dentata*, *Diospyros austroafricana* var. *austroafricana*, *Rhamnus prinoides*, *Olinia emarginata*, *Halleria lucida*, *Ilex mitis* and *Bowkeria verticillata*.

Usually there is a definite shrub layer of *Myrsine africana* about 4 ft (1·2 m) high.

Herbs present in order of abundance include *Myosotis sylvatica*, *Carex spicato-paniculata*, *Alchemilla natalensis*, *Galium rotundifolium*, *Anoiganthus breviflorus*, *Polystichum* sp. (1134), *Pteris cretica*, *Disperis fanniniae* and *Cheilanthes hirta* var. *laxa*. A succulent which occasionally forms small socies is *Aloe aristata*. Characteristic of open parts of the scrub are *Berkheya montana*, *Euphorbia epicyparissias*, *Hebenstreitia sutherlandii* and *Lithospermum afromontanum*—all about 4 ft (1·2 m) high.

The margin consists of fynbos species, for example *Philippia evansii* and *Athanasia punctata*, and tall grasses with their associates.

Climbers include *Cineraria lobata* var. *multiloba*, *C. geranifolia*, *Rio. creuxia torulosa* var. *tomentosa*, *Dioscorea sylvatica* and *Clematis brachiata-*

According to Bews (1917, p. 544) this scrub is resistant to grass-fires. It should be pointed out that the resistance is not due, as in *Protea* Savanna, to the possession by the dominants of thick insulating bark, but because the constituent species, particularly *Leucosidea sericea*, regenerate abundantly by sprouting at the base. A reliable indicator of recently burned *L. sericea* Scrub is the shrubby *Euphorbia epicyparissias*. It rapidly occupies burned parts of the scrub and ousts lower growing herbs.

(*d*) Buddleia salviifolia *Scrub*

This is a parallel community to *Leucosidea sericea* Scrub, but as a rule occupies drier areas and is associated with *Cymbopogon validus* rather than *Miscanthidium capense*.

(*e*) *Waterfall Vegetation*

Waterfalls support their own characteristic communities. To obviate lengthy description, a typical Little Berg waterfall with its vegetation is diagrammatically represented in Fig. 9. The figure is supported by Plate 22.

6.2.1.1.2. *The Lithosere*

Lithoseral succession in the Subalpine Belt can be divided into that commencing on horizontal rock outcrops and that commencing on vertical outcrops.

(A) Horizontal Outcrops

Horizontal bare-rock areas occur along the top edge of the lowermost basalt cliffs, above and adjacent waterfalls and scattered through grassland on the Little Berg. In these areas the basalt is mainly exposed to form pavements.

(*a*) *Initial Cryptogamic Stages*

Crustaceous lichens are few in number and do not play an important part in the lithosere on horizontal rock outcrops. The first mat-builders are two low-growing mosses *Campylopus trichodes* and *Ptychomitrium cucullatifolium*. They are followed by *Pogonatum simense* and *Polytrichum commune*, considerably taller species.

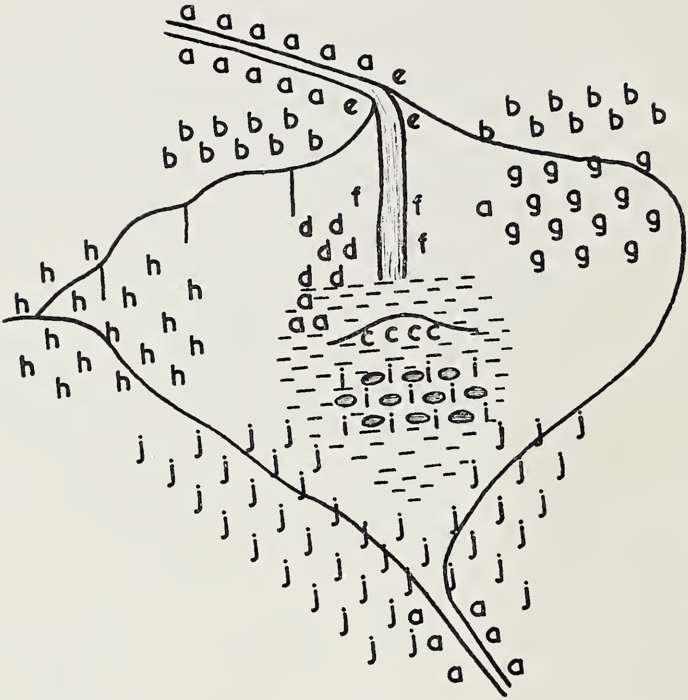

FIG. 9.—Diagrammatic sketch of a typical waterfall on the Little Berg showing its vegetation:—

(*a*) *Danthonia macowanii* and *Cliffortia linearifolia*
(*b*) Outcrop: *Crinipes gynoglossa*, *Aristida galpinii*, *Crassula harveyii* and *Vellozia viscosa*
(*c*) Islands: *Scirpus macer*, *Carex cernua*, *Juncus exertus*, *J. rostratus*, *Senecio inornatus* and *Agrostis huttoniae*
(*d*) *Berkheya multijuga* on moist rock face
(*e*) *Phygelius capensis* and Umbellifer (1227)
(*f*) Moss mats: *Philonotis afromontanum* with *Elaphoglossum spathulatum* and *Sebaea repens*
(*g*) *Ranunculus cooperi*, *Printzia pyrifolia* and *Helichrysum hypoleucum*
(*h*) *Scilla natalensis*
(*i*) *Senecio inornatus* amoug small boulders in water
(*j*) *Cymbopogon validus* or *Miscanthidium capense* var. *villosum*

Occasionally the mosses are succeeded by *Selaginella imbricata*, a creeping fern, but usually vascular plants next enter the sere.

(*b*) Crinipes–Aristida–Crassula *Communities*

Three plants are dominant in this stage, namely *Crinipes gynoglossa*, *Aristida galpinii* and *Crassula harveyii.* These species occur separately or as co-dominants.

Crinipes gynoglossa has already been discussed on p. 41. In winter the leaves of *C. gynoglossa* turn white and communities of this species show up strikingly against the red of the surrounding *Themeda triandra* Grassland (Plate 23). *Aristida galpinii* is also a xeromorphic grass, but is not so active in mat-formation. The third dominant, *Crassula harveyii*, is a cushion-forming succulent flowering in autumn.

Associated plants are common. Among the grasses are *Eragrostis caesia*, *E. racemosa*, *Digitaria ternata*, *Rhynchelytrum setifolium*, *Brachiaria serrata*, *Microchloa caffra*, *Eragrostis plana* and occasionally *Hyparrhenia hirta*. Other monocotyledons are *Scilla natalensis*, *S. bella*, *Vellozia viscosa*, *Rhodohypoxis baurii*, *Tulbaghia acutiloba*, *Moraea pubiflora*, *Albuca trichophylla*, *Anthericum longistylum* and *Urginea tenella*. Dicotyledons include *Oxalis obliquifolia*, *Pygmaeothamnus chamaedendrum* var. *setulosus* (usually in crevices), *Psammotropha myriantha*, *Crassula filiformis* (frequently in small colonies), *C. sarcocaulis*, *Anisotoma pedunculàris*, *Hermannia woodii*, *Rhus discolor*, *Thesium scirpioides*, *Indigofera hedyantha*, *Cyphia elata*, *Helichrysum adenocarpum*, *Senecio oxyriaefolius* and *Chrysocoma tenuifolia*. Several ferns are present: *Ophioglossum sarcophyllum* which occurs in small colonies, *Notholaena eckloniana*, *Pellaea calomelanos*, *P. quadripinnata* and *Mohria caffrorum*.

(*c*) Loudetia—Andropogon *Associes*

Scattered through *Themeda triandra* Grassland are areas supporting small stones and little soil. Frequently these outcrops appear as low humps. The dominants are the grasses *Loudetia simplex* and *Andropogon filifolius* with *Panicum natalense* as a subdominant. *Loudetia simplex* gives the community a grey, brown-topped colour in late January and *Andropogon filifolius* imparts a red colour in spring (November).

Associated with the dominants are *Cyperus compactus* var. *flavissimus* (occasionally locally dominant), *Bulbostylis humilis*, *Eragrostis caesia*, *E. racemosa*, *Digitaria tricholaenoides*, *Schizocarphus rigidifolius*, *S.* sp. (1567), *Hypoxis* sp. (967), *Psammotropha myriantha*, *Oxalis obliquifolia*, *Crassula rubicunda*, *Indigofera woodii* and *Senecio dregeanus* var. *discoideus*.

(*d*) *Koppie Vegetation*

Here and there on the Little Berg are koppies of varying size, the summits of which rarely exceed 6,400 ft (1,951 m). The koppies support a mixed vegetation consisting of grassland species, *Protea multibracteata*, *P. roupelliae*, *Halleria lucida*, *Rhus discolor*, *Rubus ludwigii* and numerous lithophytes.

Certain species are chracteristic of these koppies. They include *Gerbera piloselloides*, *Euryops laxus*, *Cliffortia repens*, *Anthospermum rigidum*, *Aristea cognata*, *Xysmalobium parviflorum* and *Schizoglossum flavum* var. *lineare*.

The main ecological interest of these koppies lies in the fact that they provide altitudinal limits for a number of species above or below their normal range in the Drakensberg. For example, the grasses *Danthonia stereophylla* and *D. stricta* usually occur above 7,800 ft (2,377 m) and *Aloe boylei* and *Lotononis eriantha* above 7,500 ft (2,286 m), but on koppies they occur at 6,300 ft (1,920 m). Conversely, *Haemanthus hirsutus*, *Watsonia socium* and *Helichrysum randii* are normally found below 6,100 ft (1,859 m), but are found at 6,400 ft (1,951 m) on koppies.

(*e*) *Subalpine Grassland*

There are five major grassland types in the Subalpine Belt. They are *Rendlia altera* Grassland, *Themeda triandra* Grassland, Temperate Grassland, *Themeda triandra*—Temperate Grassland and Tall Grassland.

(1) Rendlia altera *Grassland*

This grassland type is found between 6,500–8,000 ft (1,981–2,438 m) on ridges of the spurs bounding the catchment areas on the Little Berg. The soil is thin, black, peaty, often covered with small stones and occasionally interrupted by basalt outcrops. The grasses are mostly short and characteristic of early stages in the grassland succession. The dominant is *Rendlia altera*. Associated with it are *Sporobolus centrifugus* var. *laxivaginatus*, *Eragrostis capensis*, *E. racemosa*, *Andropogon filifolius*, *Panicum ecklonii* and on basalt outcrops *Crinipes gynoglossa*. Where soil conditions are more favourable *Themeda triandra*, *Heteropogon contortus*, *Koeleria cristata*, *Harpechloa falx* and other constituents of *Themeda triandra* Grassland make their appearance. Sedges are fairly frequent and include *Cyperus semitrifidus*, *Bulbostylis humilis*, *B. trichobasis* and *Scirpus falsus*.

Herb socies are common. Large and frequent socies are formed by *Rhodohypoxis baurii* forma *platypetala*, a small white-flowered geophyte which is conspicuous during spring (Plate 24). At the other extreme are the very local and small socies formed by species like *Wurmbea krausii*, *Moraea mossii* and the orchid *Schizochilus angustifolius*. The remaining herbs arranged more or less in order of importance are:—

Aster perfoliatus
Senecio bupleuroides
Lotononis eriantha
Oxalis obliquifolia
Psammotropha myriantha
Euryops pedunculatus
Erica woodii
Tetraria cuspidata
Lessertia thodei
Zaluzianskya pulvinata
Gazania krebsiana
Wahlenbergia montana
Moraea sp. (1260)
Gladiolus woodii
Othonna natalensis
Dipcadi gracillimum
Monsonia attenuata
Cyphia elata
Kniphofia evansii

Several dwarf shrubs which become more important at higher altitudes on the ridges are also present. They are *Lotononis* sp. (1191), *Gnidia compacta*, *Buchenroedera lotononoides*, *Passerina montana* and *Polygala myrtifolia*. Occasionally *Protea dracomontana* is also present.

(2) Themeda triandra *Grassland*

This grassland type is the most extensive in the Subalpine Belt: it covers most of the Little Berg (see Plate 2 and Fig. 6). On xerocline slopes it extends from the top of the lowermost basalt cliffs to about 8,500 ft (2,591 m) and on mesocline slopes it reaches 7,000 ft (2,134 m). Above 8,500 ft (2,591 m) on xerocline slopes *Themeda triandra* Grassland loses its identity and mixes with Temperate Grassland and ultimately *Danthonia–Festuca–Pentaschistis* Grassland. *Themeda triandra* itself drops out at about 9,300 ft (2,835 m).

Between 6,000–7,000 ft (1,829–2,133 m) *Themeda triandra* Grassland is fairly uniform in composition and basal cover. Three catchments on the Research Area of approximately 300 acres (121 Ha) each, lying within this altitudinal range, were selected for analysis. Catchments 3 and 4,

adjacent-lying north-facing catchments, were sampled by the Wheel Point Method of Tidmarsh & Havenga (1955) in February and March, 1951, respectively. Catchment 9, a south-east-facing catchment was sampled by the Skewer Point Method in April, 1953. The Skewer Point Method was devised by the author as a refinement of existing point methods and will be described in a separate paper. The results of the three analyses are given in Table 9.

Examination of Table 9 reveals that in spite of aspect differences the catchments show very similar results particularly in respect of the major species.

Total basal cover is high varying between 42·30 per cent in Catchment 9 to 47·45 per cent in Catchment 4. Volume is also high. *Themeda triandra* is dominant with a basal cover of about 12 per cent. Immediately subordinate to *T. triandra* are four grasses *Trachypogon spicatus*, *Tristachya hispida*, *Harpechloa falx* and *Heteropogon contortus*, the hierarchy varying from catchment to catchment. It was noticed during the analyses that *Heteropogon contortus* is abundant on shallow soil, while *Harpechloa falx* apparently favours deep moist soil.

The remaining grasses recorded in the analysis are 18 in number the more important being *Alloteropsis semialata*, *Rendlia altera*, *Elyonurus argenteus*, *Andropogon ravus*, *Koeleria cristata*, *Panicum ecklonii*, *P. natalense*, *Monocymbium ceresiiforme*, *Andropogon appendiculatus* and *Loudetia simplex*.

Grasses occurring in *Themeda triandra* Grassland but missed in the analyses are *Eulalia villosa*, *Pennisetum sphacelatum*, *Digitaria flaccida*, very often found under *Protea* trees, and *Ischaemum franksiae* which though common in grassland in the Montane Belt, is apparently very rare on the Little Berg.

Sedges are few and include *Bulbostylis trichobasis*, *B. schoenoides*, *Ficinia cinnamomea*, *Cyperus compactus* var. *flavissimus*, *Scleria woodii* and *S. bulbifera*.

Associated forbs are more numerous than the results of the analyses suggest. There are about 100 species which form seasonal aspect socies of varying size and constancy.

The main flush of forbs appears in spring. The more constant vernal species arranged in approximate order of abundance are:—

Acalypha punctata	*Helichrysum aureonitens*
A. depressinervia	*Senecio bupleuroides*
Hypoxis spp.	*Aster perfoliatus*
Pentanisia prunelloides	*Watsonia lepida*
Scilla bella	*Helichrysum acutatum*
Oxalis obliquifolia	*Aster pleiocephalus*
Kohautia amatymbica	*Senecio caudatus*
Eriosema kraussianum	*Helichrysum scapiforme*
Graderia scabra	*Zaluzianskya maritima*

Acalypha punctata and *A. depressinervia*, probably the commonest forbs on the Little Berg, frequently form socies whose boundaries coincide with those of *Pteridium aquilinum* i.e. open and not closed *P. aquilinum*.

TABLE 9.—Wheel Point Analyses of *Themeda triandra* Grassland in Catchments 3, 4 and 9 on the Little Berg

Catchment 3		Catchment 4		Catchment 9	
Species	Percentage Basal Cover	Species	Percentage Basal Cover	Species	Percentage Basal Cover
Themeda triandra	11·55	*Themeda triandra*	12·25	*Themeda triandra*	12·10
Trachypogon spicatus	5·05	*Trachypogon spicatus*	6·15	*Tristachya hispida*	8·55
Tristachya hispida	4·60	*Tristachya hispida*	5·20	*Harpechloa falx*	5·20
Harpechloa falx	4·40	*Heteropogon contortus*	4·65	*Trachypogon spicatus*	3·70
Heteropogon contortus	4·10	*Harpechloa falx*	3·45	*Heteropogon contortus*	2·45
Rendlia altera	3·20	*Rendlia altera*	3·45	*Stiburus alopecuroides*	1·85
Alloteropsis semialata	2·00	*Alloteropsis semialata*	3·25	*Andropogon appendiculatus*	1·65
Elyonurus argenteus	1·80	*Elyonurus argenteus*	1·85	*Andropogon ravus*	1·35
Bulbostylis trichobasis	0·95	*Andropogon ravus*	0·95	*Koeleria cristata*	1·35
Stiburus alopecuroides	0·90	*Bulbostylis trichobasis*	0·85	*Bulbostylis schoenoides*	1·15
Andropogon ravus	0·75	*Koeleria cristata*	0·75	*Panicum ecklonii*	0·95
Other (?)	0·60	*Panicum ecklonii*	0·70	*Rendlia altera*	0·80
Koeleria cristata	0·55	*Stiburus alopecuroides*	0·65	*Ficinia cinnamomea*	0·35
Panicum natalense	0·40	Other (?)	0·65	*Panicum natalense*	0·20
Panicum ecklonii	0·35	*Panicum natalense*	0·55	*Cyperus compactus*	0·20
Androgopon appendiculatus	0·25	*Monocymbium ceresiiforme*	0·40	*Oxalis obliquifolia*	0·15
Bulbostylis schoenoides	0·25	*Andropogon appendiculatus*	0·30	*Bromus speciosus*	0·15
Loudetia simplex	0·15	*Hypoxis acuminata*	0·25	*Alloteropsis semialata*	0·05
Acalypha punctata	0·15	*Loudetia simplex*	0·20	*Senecio harveyanus*	0·05
Scilla bella	0·15	*Acalypha punctata*	0·15	*Helichrysum allioides*	0·05
Ficinia cinnamomea	0·10	*Eragrostis racemosa*	0·10		
Cymbopogon validus	0·05	*Poa binata*	0·10		
Eragrostis racemosa	0·05	*Anthospermum hedyotideum*	0·10		
Monocymbium ceresiiforme	0·05	*Oxalis obliquifolia*	0·10		
Alepidea capensis	0·05	*Scilla bella*	0·10		
Erica woodii	0·05	*Scleria woodii*	0·10		
Helichrysum adenocarpum	0·05	*Aristea angolensis*	0·05		
Helichrysum glomeratum	0·05	*Ficinia cinnamomea*	0·05		
Tetraria cuspidata	0·05	*Lobelia flaccida* var.	0·05		
Satyrium longicauda	0·05	*Scleria bulbifera*	0·05		
Polygala rehmannii	0·05				
Scleria bulbifera	0·05				
Scleria woodii	0·05				
Cyperus compactus var. *flavissimus*	0·05				
TOTAL	42·90	TOTAL	47·45	TOTAL	42·30

Less constant are the following species. Among the monocotyledons are *Rhodohypoxis baurii*, *Hypoxis multiceps*, *Eriospermum cooperi*, *Scilla saturata*, *Moraea culmea*, *M. modesta*, *Gladiolus woodii*, *G. longicollis*, *Tritonia lineata*, *Aristea angolensis* and *Disa stachyoides*. *Hypoxis multiceps*, a very broad-leaved *Hypoxis*, forms extensive socies in Catchment 1, yet is absent in most of the other catchments on the Research Area. Dicotyledons include:—

Helichrysum caespititium
H. latifolium
Senecio sp. (1059)
S. macrocephalus
Hebenstreitia dentata
Selago monticola
S. sp. (1637)
Nemesia cynanchifolia
N. denticulata
Schizoglossum pulchellum
Asclepias schizoglossoides
A. stellifera
Raphionacme hirsuta
Polygala rehmannii
Euphorbia ericoides
E. guenzii
E. guenzii var. *albovillosa*
Thesium racemosum
Silene burchellii
Adhatoda andromeda
Epilobium flavescens
Wahlenbergia undulata

Euphorbia guenzii and its variety *albovillosa* have only been seen by the author at 6,100 ft (1,859 m) on the northern slopes below Eastman's Peak.

Summer is characterized by the appearance of orchids. The orchids include, in order of importance, *Satyrium longicauda*, *Disa macowanii*, *Eulophia foliosa*, *E. hians*, *Disperis tysonii*, *Habenaria orangana*, *H. petri*, *Disperis stenoplectron*, *Neobolusia* sp. (1403), *Disa* sp. (1208) and *Disperis cardiophora*. Other families are represented by:—

Helichrysum acutatum
H. adscendens
H. allioides
Vernonia hirsuta
Haplocarpha scapiforme
Manulea thodeana
Sutera breviflora
Sopubia cana
Buchnera dura
Schizoglossum linifolium
Pachycarpus campanulatus var. *sutherlandii*
Satureia grandibracteata
Polygala hottentota
Alepidea capensis
Pelargonium flabellifolium
Trifolium burchellianum
Drimia neriniformis
Dierama robustum
Ophioglossum sarcocaulon

Most of these plants are fairly widespread in *Themeda triandra* Grassland. Several plants are, however, apparently exclusive. For example, the recently described *Satureia grandibracteata* has only been recorded in Catchments 8 and 9, while *Trifolium burchellianum* which is common in seepage areas on the summit of the Drakensberg in the Alpine Belt has only been seen by the author in Catchment 1 where it forms a small socies with *Ophioglossum sarcocaulon* at 6,250 ft (1,905 m).

Few forbs appear in autumn. The list includes *Erica woodii*, *E. oatesii*, *Crassula vaginata*, *Helichrysum squamosum*, *H. glomeratum*, *H. adenocarpum*, *Sebaea filiformis*, *Wahlenbergia squamifolia* var. *tenuis* and *W. fasciculata*. In addition, there are tall-growing species which occur in *Themeda triandra* Grassland, but which are more abundant in Tall Grassland. These include species like *Lessertia perennans*, *Plectranthus calycinus* and *Leonotis dysophylla*.

During winter most forbs are inactive. One of the first plants to appear after late autumn or winter burning is *Anoiganthus luteus*, a small yellow-flowered geophyte. The only forbs recorded in unburnt veld during winter are *Lasiosiphon* sp. (1750), *Athrixia arachnoidea* and *Erica oatesii.*

Terracettes in *Themeda triandra* Grassland support their own communities. Where the soil has recently been exposed, *Aristida galpinii* appears. It is followed by *Eragrostis racemosa* and *E. capensis.* Eventually the terracettes are occupied by *Monocymbium ceresiiforme* (Plate 25) which is occasionally accompanied by *Trachypogon spicatus.*

Between 7,000–8,500 ft (2,133–2,591 m) *Themeda triandra* Grassland takes on new associates. *Eucomis humilis* and *Urginea macrocentra* form conspicuous communities either pure or mixed at the foot of small cliffs. Other species occurring in this region are:—

Euryops pedunculatus	*Bupleurum mundtii*
Tetraria cuspidata	*Heliophila rigidiuscula*
Kniphofia porphyrantha	*Pimpinella caffra*
Aloe boylei	*Senecio hieracioides*
Dierama igneum	*Lobelia filiformis* var. *natalensis*
Osteospermum juncundum	*Pachycarpus* sp. (1203)
O. thodei	*Sutera breviflora*
Agapanthus campanulatus	

A comparison of *Themeda triandra* Grassland in the Subalpine Belt with that in the Montane Belt reveals the following differences:—

(1) Total basal cover is higher: 42·30–47·45 per cent as against 33·8 per cent.

(2) *Themeda triandra* has a higher basal cover: 11·55–12·25 per cent as compared with 8·3 per cent.

(3) Typical sourveld species such as *Trachypogon spicatus, Harpechloa falx, Heteropogon contortus, Alloteropsis semialata, Elyonurus argenteus* and *Koeleria cristata* are more important.

(4) *Hyparrhenia hirta*, which contributes 2·6 per cent of the total basal cover in the Montane Belt and is a potential dominant, is absent in subalpine *Themeda triandra* Grassland.

Subalpine *Themeda triandra* Grassland falls under Acocks's Highland Sourveld (1957, p. 121). Acocks's species list for Highland Sourveld agrees fairly closely with the results of the Little Berg analyses. The main disagreement concerns the relative importance of *Eragrostis racemosa* (=*E. chalcantha*) and *Harpechloa falx.* Acocks includes *Eragrostis racemosa* with the subdominants *Trachypogon spicatus, Tristachya hispida* and *Heteropogon contortus* and treats *Harpechloa falx* as a minor species. Table 9 shows that on the Little Berg this situation is reversed.

The Effect of Fire

Observations were made on the effect of fire on the flowering and growth of the major grass species. These observations were few and covered only short periods of time, consequently their botanical value is to a certain extent limited.

Between 18–28 May, 1952, a firebreak was burnt immediately west of Catchment 2. On 18 July, 1952, after the first July rains the belt was substantially widened. In addition, two smaller belts on the boundary of Catchment 2 were studied. The first was burnt in May, 1951, and the second on 15 August, 1951, after the first spring rains. The results are presented in Table 10.

From Table 10 it will be seen that autumn burning prevents general flowering of the grasses. Some of the spring and summer-flowering grasses like *Alloteropsis semialata*, *Harpechloa falx*, *Koeleria cristata* and *Panicum ecklonii* flower sporadically, but *Themeda triandra*, *Heteropogon contortus* and *Tristachya hispida* do not flower at all. Of the autumn-flowering grasses *Monocymbium ceresiiforme*, *Stiburus alopecuroides* and *Andropogon ravus* flower occasionally, but *Trachypogon spicatus*, one of the subdominants does not flower. Leaf growth after autumn burning is poor and the sward as a whole is short and has low volume.

Burning in winter after rain permits the flowering of the spring and summer grasses with the exception of *Themeda triandra* and *Heteropogon contortus*. It inhibits the flowering of the autumn grasses. If the grassland is not burnt the following season *Themeda triandra* and *Heteropogon contortus* flower prolifically and also the autumn grasses *Trachypogon spicatus* and *Monocymbium ceresiiforme*. Leaf growth is vigorous.

Spring burning permits the flowering of all the grasses and produces good leaf growth. It is the policy of the Forestry Department to burn biennially in spring after the first rain of $\frac{1}{2}$ in ($12 \cdot 7$ mm) or more. This policy is largely responsible for the dominance and high basal cover of *Themeda triandra* on the Little Berg.

Observations have also been made on the effect of complete protection on *Themeda triandra* Grassland. In Catchment 2, which has been protected since it was planted up with *Pinus patula* in 1951, *Trachypogon spicatus*, *Alloteropsis semialata* and *Elyonurus argenteus* seem to be increasing at the expense of *Themeda triandra*. The grassland is becoming rank and there is an obvious increase in tall herbs and shrubs such as *Plectranthus calycinus*, *Leonotis dysophyllus* and *Athanasia punctata*. In other words, with protection from fire, the succession advances.

(3) *Temperate Grassland*

This grassland can be subdivided into three consocies dominated by species belonging to temperate genera. The consocies are *Festuca costata* Grassland, *Pentaschistis tysonii* Grassland and *Bromus speciosus* Grassland.

(*i*) *Festuca costata* Grassland.—This grassland occurs in mesic situations in the lower part of the Subalpine Belt, for example streambanks and the south side of koppies, and in both mesic and xeric situations in the upper part. Its altitudinal distribution is between 6,000–9,400 ft (1,829–2,865 m).

Festuca costata is a tall evergreen tussock-forming grass with an average leaf height of 2 ft ($0 \cdot 6$ m) and culms about 4 ft ($1 \cdot 2$ m). The leaves are flat, recurved and xeromorphic. The grass is summer-flowering. If *Festuca costata* is not burnt for several seasons, it becomes dense and the leaves arch in a very pronounced manner.

F. costata very rarely forms a pure sward: the tussocks are separated by shorter grasses like *Themeda triandra*, *Koeleria cristata*, *Poa binata*, *Agrostis barbuligera*, *Rendlia altera*, *Aristida monticola*, *Anthoxanthum*

TABLE 10.—Effect of burning at different times of the year on *Themeda triandra* Grassland

Burn in May 1951	Burn on 15/8/1951	Burn on 18 or 28/5/1952	Burn on 18/7/1952
First Season:			
Sporadic flowering of *Koeleria cristata, Eragrostis racemosa, Monocymbium ceresiiforme, Andropogon ravus* and *Stiburus alopecuroides*	All grasses flowering....	Sporadic flowering of *Harpechloa falx, Alloteropsis semialata, Koeleria cristata, Panicum ecklonii* and *Monocymbium ceresiiforme*	Prolific flowering of *Harpechloa falx, Alloteropsis semialata, Koeleria cristata, Panicum ecklonii, Tristachya hispida, Andropogon filiformis, Elyonurus argenteus, Rendlia altera* and *Eragrostis capensis.*
No flowering of *Themeda triandra, Heteropogon contortus, Tristachya hispida, Trachypogon spicatus* and *Harpechloa falx*	—	No flowering of *Themeda triandra, Heteropogon contortus, Elyonurus argenteus, Tristachya hispida* and *Trachypogon spicatus*	No flowering of *Themeda triandra, Heteropogon contortus, Trachypogon spicatus* and *Monocymbium ceresiiforme.*
Poor leaf growth.....................	Good leaf growth.......	Poor leaf growth....................	Good leaf growth.
Second Season:			
—	—	Grassland rested....................	Grassland rested.
—	—	Very sporadic flowering of most grasses	Prolific flowering of *Themeda triandra, Heteropogon contortus, Trachypogon spicatus* and *Monocymbium ceresiiforme.*

ecklonii, *Andropogon appendiculatus* and *Danthonia stricta* (Plate 26). Immediately surrounding each tussock is a bare area 4–6 in (10·2–15·2 cm) wide probably caused by deep shade.

Herb associates arranged more or less in order of abundance include the following:—

Alepidea setifera	*Leontonyx coloratus*
Berkheya rhapontica s.sp. *aristosa* var. *exalata*	*Silene capensis*
Anemone fanninii (forms large socies in the upper Indumeni Valley)	*Tetraria cuspidata*
Helichrysum adenocarpum	*Wahlenbergia montana*
Vernonia barbatus	*Wurmbea kraussii*
Alepidea capensis	*Lotononis eriantha*
Haplocarpha scaposa	*Stachys* sp. (1286)
Aster perfoliatus	*Schoenoxiphium filiforme*
Scilla bella	*Euphorbia ericoides*
Crassula setulosa	*Helichrysum fulgidum*
Mohria caffrorum	*Erica westii*
Cenia hispida	*Rhodohypoxis baurii*
Psammotropha myriantha	*Cerastium dregeanum*
Athrixia angustissima	*Gladiolus subaphyllus*
Ursinia apiculata	*Argyrolobium tuberosum*
Helichrysum grandibracteatum	*Helichrysum appendiculatum*
Oxalis obliquifolia	*Notosceptrum brachystachyum*
Scabiosa columbaria	*Pellaea quadripinnata*
Sebaea procumbens	*Hebenstreitia comosa*
Kniphofia pauciflora	*Selago flanaganii*
	Moraea sp. (2139)
	Schizochilus sp. (1324)
	Satureia compacta

The slopes supporting *Festuca costata* Grassland are heavily scarred with terracettes. The walls of these terracettes often support colonies of mosses and on the floors *Andropogon appendiculatus* is dominant. *Oxalis obliquifolia* establishes itself on parts of the floor where soil has recently been deposited.

(*ii*) *Pentaschistis tysonii* Grassland.—This community covers very large areas in the Subalpine Belt, yet it has been completely overlooked by previous workers. It occurs between 6,500–7,500 ft (1,981–2,287 m) on mesocline slopes and between 8,500–9,400 ft (2,591–2,865 m) on xerocline slopes. In other words *Pentaschistis tysonii* Grassland has a very similar distribution to *Festuca costata* Grassland except that it does not occur on koppies and streambanks in the lower part of the Subalpine Belt.

Usually *Pentaschistis tysonii* is dominant in pure stands, but occasionally it mixes with *Festuca costata*. Just what the individual ecological requirements of *P. tysonii* and *F. costata* are is difficult to establish.

Pentaschistis tysonii is a summer-flowering evergreen xeromorphic grass with tightly rolled leaves. It forms a dense sward about 1 ft (30·4 cm) high. Chippindall (1955, p. 261) refers to this grass as a variety of *P. tysonii* with hairy glumes about $\frac{3}{8}$ in (10 mm) long, but it is accepted as typical *P. tysonii* in the National Herbarium, Pretoria.

Associates are few. Among the grasses are *Agrostis barbuligera*, *Sporobolus centrifugus*, *Bromus speciosus*, *Andropogon appendiculatus*, *Koeleria cristata*, *Harpechloa falx*, *Elyonurus argenteus*, *Danthonia stricta*

and *Rendlia altera.* The main summer-flowering forbs appear in three distinct waves. In November *Senecio praeteritus* is very abundant, particularly in the upper part of the Indumeni Valley. In December and January *Senecio bupleuroides*, *S. barbatus*, *Helichrysum allioides*, *Vernonia hirsuta*, *Zaluzianskya maritima*, *Hebenstreitia dentata* and *Sutera breviflora* are conspicuous, while in February *Alepidea capensis*, *Haplocarpha scaposa* and *Hebenstreitia dentata* are the chief forbs. *Heteromma* sp. (1948), a tall composite, which forms large communities in the Tutumi Valley, flowers in April. Other forbs present in *Pentaschistis tysonii* Grassland are *Aster perfoliatus*, *Berkheya rhapontica* subsp. *aristosa* var. *exalata*, *Senecio* sp. (1823), *Wahlenbergia montana*, *Cycnium racemosum*, *Thesium racemosum*, *Erica* sp. (2189), *Albuca baurii*, *Pimpinella stadensis*, *Kniphofia pauciflora* (abundant on S.W. slopes of the Camel), *K. evansii*, *Moraea* sp. (1260) and *Ficinia* sp. (1383).

(*iii*) *Bromus speciosus* Grassland.—This grassland has a similar distribution to that of *Festuca costata* Grassland, but is not as extensive—at least not in the Cathedral Peak area. According to West (1951, p. 50) *Bromus speciosus*—Other spp. Grassveld is well developed between 7,000–8,000 ft (2,133–2,438 m) at Bushmans Pass and below Giants Castle.

Bromus speciosus is a broad-leaved grass with leaves about 9–12 in (22·9–30·5 cm) long and culms up to 4 ft (1·2 m) high. It is not as xeromorphic as the other two dominants of Temperate Grassland.

Like *Festuca costata*, *Bromus speciosus* does not form a close sward: the tussocks are spaced at intervals of 3–5 ft (0·9–1·5 m). Between the tussocks are short grasses and forbs, the species being the same as those for *Festuca costata* Grassland, with the addition of *Cineraria geranifolia.*

A note by West (1951, pp. 50–51) regarding a xeromorphic form of *Bromus speciosus* occurring on slopes exposed to full insolation deserves comment. West states that this form, which he did not find in flower, has leaves which are heavily cutinized, very hard and stiff. He suggests that it might be some other species of *Bromus*. However, there is a possibility that it may be *Festuca costata.* Compare Plate 26 with West (1951, Plate VII). The fact that West does not mention *F. costata* at all in his description of " alpine vegetation " rather supports this suggestion.

Note on the Distribution of *Festuca costata*, *Pentaschistis tysonii* and *Bromus speciosus* in the Drakensberg

The distribution of *Festuca costata*, *Pentaschistis tysonii* and *Bromus speciosus* in the Drakensberg area poses an ecological problem. As already mentioned these grasses are xeromorphic and evergreen, yet they are generally restricted to mesic sites, namely streambanks, the south sides of koppies and mesocline slopes above 6,500 ft (1,981 m). They also grow on xerocline slopes in the upper part of the Subalpine Belt, due probably to the higher rainfall at those altitudes, which cancels out the effect of unfavourable aspect. Professor C. L. Wicht, in conversation with the author, has suggested the following explanation for the distribution of these grasses. The xerocline slopes are much drier than the mesocline slopes and support a vegetation (*Themeda triandra* Grassland) which is able to avoid the dry winter by going into dormancy. On the mesocline slopes there is no need to go into dormancy, hence the presence of grasses like *Festuca costata*, *Pentaschistis tysonii* and *Bromus speciosus* which are evergreen.

But why should these grasses be xeromorphic? It is very probable that during winter the mesocline slopes are liable to periods of physiological drought. This condition could be induced in any of the following ways:—

(1) When the soil is frozen and soil water is unavailable. According to Mr. A. M. de Villiers, former District Forest Officer at Cathedral Peak, the slopes supporting Temperate Grassland are frozen for most of winter, but the author's observations during several winters do not support this assertion.

(2) When strong drying winds blow at the end of winter and in early spring, when soil holard is low.

(3) When soil temperatures are low, but above freezing point, the soil has reduced capacity to give up water to the roots. This can be due to increased water-holding capacity and moisture equivalent to the soil (Daubenmire, 1957, pp. 321–322) or increased viscosity of the soil-water (Daubenmire, 1947, p. 205). Low soil temperatures also increase the viscosity of root protoplasm making water-absorption difficult (Daubenmire, l.c., p. 205). Daubenmire states: " Experimentally it has been shown that cold soil induces the same structural modifications as drought ".

(4) Themeda triandra—*Temperate Grassland*

Above about 8,500 ft (2,591 m) on xerocline slopes *Themeda triandra* Grassland mixes in varying proportions with the Temperate Grassland types. Between Cathkin Peak and Mont aux Sources the Drakensberg faces roughly north east, consequently the buttress slopes of the main escarpment are chiefly xeroclinal and support extensive tracts of *Themeda triandra*—Temperate Grassland. The buttress slopes are steep and often have only a thin covering of soil.

With increase in altitude certain constituent species of *Themeda triandra* and the Temperate Grassland types become more important and other plants are added.

Between 8,500–9,000 ft (2,591–2,743 m) the situation is as follows. Among the grasses *Aristida monticola*, much dwarfed in stature, assumes greater importance and in parts is even locally dominant. Also prominent are *Koeleria cristata*, *Trachypogon spicatus*, *Tristachya hispida*, *Eragrostis racemosa*, *Anthoxanthum ecklonii*, *Helictotrichum hirtulum*, *Penthaschistis pilosogluma* and *Ehrharta longigluma*. Herbs present include:—

Heteromma sp. (1948)
Senecio haygarthii (stunted and often single-stemmed)
Berkheya rhapontica subsp. *aristosa* var. *exalata*
B. macrocephala
Euryops pedunculatus
Helichrysum drakensbergense
H. umbraculigerum
Selago monticola
Erica woodii
Bupleurum mundtii
Wahlenbergia undulata
Kniphofia sp. (1857)
Urginea macrocentra
Agapanthus campanulatus
Schoenoxiphium filiforme
Tetraria cuspidata
Pellaea quadripinnata

Above 9,000 ft (2,743 m) *Danthonia disticha*, *Festuca caprina* and *Penthaschistis oreodoxa*, the dominant grasses of the Alpine Belt, enter the associes and the result is a grassland ecotone. *Koeleria cristata*, *Harpechloa falx* and *Eragrostis caesia* become more prominent and are accompanied

by three grasses which seem to be exclusive to this ecotone, namely *Festuca scabra*, *F.* sp. (1835), an undescribed species allied to *F. costata* and frequently found among boulders, and *Danthonia* sp. (1727), a golden-topped species also undescribed. Other plants characteristic of this region are:—

Bojeria nutans
Pentzia pinnatifida
Senecio macrocephalus
Helichrysum cooperi
Guthriea capensis
Erica woodii
E. alopecurus
Schizoglossum sp. (1838)
Stachys dregeana
Diascia sp. (1488)
Dianthus basuticus subsp. *basuticus* var. *grandiflorus*
Lobelia flaccida var. *hirsutus*
L. preslii
Lotononis trisegmentata var. *robusta*
Fumaria officinalis
Eucomis bicolor
Moraea spathulata (near streams)
Cyrtanthus erubescens

With the exception of *Dianthus basuticus* subsp. *basuticus* var. *grandiflorus*, the majority of these herbs form socies.

(5) *Tall Grassland*

Under this heading are included three grass communities dominated by tall grasses and having very similar ecological characteristics. It should be pointed out that the name Tall Grassland is used for convenience and does not imply any relationship with the Southern Tall Grassveld of Acocks (1953, p. 147).

(i) *Miscanthidium capense* Grassland.—This community is found on streambanks, moist flats and in gullies below 6,500 ft (1,981 m). On the Little Berg it covers areas up to 5 acres (2 Ha) in extent. In the hydrosere the community succeeds the semi-aquatic communities and the *Danthonia macowanii* Consocies, and in the lithosere it succeeds *Themeda triandra* Grassland and Temperate Grassland.

The dominant is *Miscanthidium capense* var. *villosum* with culms 5–8 ft (1·5–2·4 m) tall. The grass forms a fairly dense sward, usually pure, but sometimes mixed with *Cymbopogon validus* or *Hyparrhenia aucta*.

The majority of the associated plants are tall herbs and shrubs, some of which are autumnal aspect plants. The two families best represented are Labiatae and Compositae. In the Labiatae are *Leonotis dysophyllus*, *Plectranthus calycinus*, *P. grallatus*, *Stachys albiflora*, *Pycnostachys reticulata* and the creeping *Satureia reptans*, and in the Compositae are *Schistostephium crataegifolium*, *Nidorella polycephala*, *Heteromma decurrens*, *Vernonia hirsuta*, *Artemisia afra*, *Senecio isatideus*, *Helichrysum cooperi*, *H. umbraculigerum* and *Athanasia punctata*.

The remaining constituents are:—

Eragrostis curvula forma
Pellaea quadripinnata
Curtonus paniculatus
Kniphofia longiflora
Eulophia calanthoides
Zantedeschia albomaculata
Anemone fanninii
Gunnera perpensa
Silene burchellii
Hibiscus hastaefolius
Rhynchosia caribaea
Lessertia perennans
Indigofera cuneifolia
I. longebarbata
Geranium pulchrum
Pelargonium flabellifolium
Euphorbia ericoides
Acalypha punctata
Tysonia africana
Rhus discolor
Manulea thodeana
Galium wittbergense

(ii) *Hyparrhenia aucta* Grassland.—As (i) above, but the dominant is *Hyparrhenia aucta* and usually the community occupies much smaller areas.

(iii) *Cymbopogon validus* Grassland.—As (i) above, but the dominant is *Cymbopogon validus* with a culm height of 1–4 ft (0·6–1·2 m). In addition, the community occupies smaller areas and occurs up to 9,000 ft (2,743 m) instead of 6,500 ft (1,981 m).

(*f*) *Bracken Veld*

Bracken Veld is found on moist deep soil in most catchments on the Little Berg up to about 7,000 ft (2,133 m)—a refutation of Schelpe's statement (1946, p. 21) that " it appears improbable that *Pteridium* will enter the grasslands above the Cave Sandstone cliffs ". *Pteridium aquilinum* invades *Themeda triandra* Grassland and the lower parts of Temperate Grassland.

The vegetational changes which take place when *Themeda triandra* Grassland is invaded by *Pteridium aquilinum* have been observed in some detail. Initially *P. aquilinum* occurs in socies in *Themeda triandra* Grassland, but in time and under favourable conditions, it closes up, the fronds from adjacent plants overlap and deep shade is produced. Light readings as low as one tenth of those taken in sunlight have been recorded under *Pteridium aquilinum*. *P. aquilinum* is joined quite early by *Rubus ludwigii*, *Plectranthus calycinus*, *Helichrysum cooperi*, *H. setosum* and occasionally *Rhus discolor*.

Eventually the constituents of *Themeda triandra* Grassland are shaded out, *Koeleria cristata* and the forbs *Scilla bella*, *Acalypha punctata*, *A. depressinervia*, *Hypoxis* spp., *Oxalis obliquifolia* and *Pentanisia prunelloides* persisting for some time. The ground at this stage is nearly bare of vegetation—a condition which can be clearly seen directly after a grass fire.

Other grasses and herbs then make their appearance, the most common being *Poa binata*, *Helictotrichum turgidulum*, *Agrostis huttoniae*, *Ajuga ophrydis*, *Cynoglossum enerve* and *Satureia reptans*.

Closed Bracken Veld is next invaded by tall herbs, for example *Tysonia africana*, *Anemone fanninii*, *Senecio isatideus*, *Helichrysum umbraculigerum*, *Kniphofia longiflora* and *Lessertia perennans*.

Bracken Veld eventually yields to fynbos, chiefly communities dominated by the shrubs *Clutia natalensis*, *Melianthus villosus*, *Calpurnia intrusa*, *Athanasia punctata*, *Syncolostemon macranthus*, *Myrsine africana*, *Euphorbia epicyparissias*, *Asparagus* spp. and *Royena hirsuta*.

(*g*) Miscanthidium—Pteridium *Associes*

This community results from the invasion of Bracken Veld by *Miscanthidium capense* var. *villosum*. It covers fairly large areas and is widespread on the Little Berg.

(*h*) Protea *Savanna*

Protea Savanna, dominated by *Protea multibracteata* and *P. roupelliae*, is very limited in extent on the Little Berg: generally it is restricted to koppies and the stony ridges of spurs up to 7,000 ft (2,133 m) where there is some protection from fire.

(*i*) *Ridge Vegetation*

The ridges of spurs on the Little Berg above 8,000 ft (2,438 m) support a mixed vegetation which is markedly xeromorphic. The reason for the mixed nature of the flora is that the ridges form an ecotonal region between the Alpine and Subalpine Belts and they lie between the major subalpine grassland types i.e. *Themeda triandra* Grassland on xerocline slopes and *Festuca costata* or *Pentaschistis tysonii* Grassland on mesocline slopes. The vegetation is xeromorphic because the ridges are rocky and exposed to strong winds. The vegetation consists of dwarf shrubs, cushion and rosette plants, grasses and other herbs. A great many of the plants are confined to rock crevices.

The two dominant dwarf shrubs are *Passerina montana* and *Erica thodei*, both with ericoid leaves. They form a fairly open community (Plate 27).

Secondary species are *Lotononis* sp. (1191), *Buchenroedera lotononoides* and *Polygala myrtifolia*. These three species illustrate very strikingly the effect of altitude on plant size. *Lotononis* sp. (1191) grows up to 5 ft (1·5 m) tall in Boulder-bed Scrub, *Buchenroedera lotononoides* averages about 3 ft (0·9 m) in *Themeda triandra* Grassland, and *Polygala myrtifolia* about 3 ft (0·9 m) along the margin of *Podocarpus latifolius* Forest, but on the ridges these species have a low spreading growth and scarcely exceed 1 ft (30·5 cm) in height.

Other dwarf shrubs are *Gnidia compacta*, a prostrate species with masses of small yellow flowers, *Muraltia saxicola* which frequently spreads over vertical faces, *Cliffortia spathulata*, *Thesium imbricatum*, *Pentzia pinnatifida* var. *chenoloides*, *Sutera pristisepala*, *Osteospermum thodei* and *Euryops pedunculatus*.

In addition to *Erica thodei* there are several other species of *Erica*, namely *E. frigida*, *E. dykei*, *E. algida* and *E. reenensis*. *E. frigida* and *E. dykei* are fairly common and form low cushions or carpets up to 6 in (15·2 cm) high, while *E. algida* and *E. reenensis* are only occasional and do not spread.

The suffrutices are mainly grey-lanate species of *Helichrysum*. They include *H. argentissimum*, *H. odoratissimum*, *H. splendidum* var. *montanum*, *H. sutherlandii*, *H. setigerum* and *H. infaustum*. Also present is *Leontonyx coloratus*.

Rosette plants are numerous and comprise chiefly composites. Among the composites are *Helichrysum alticolum* var. *montanum*, *H. scopulosum*, *H. sessile* and *H. confertum*, *Cenia hispida*, *Ursinia apiculata* and *Berkheya rhapontica* subsp. *aristosa* var. *exalata*. Other families are represented by *Wahlenbergia montana*, *Zaluzianskya pulvinata* and *Psammotropha myriantha*. In some cases, for example *Helichrysum confertum* and *H. sessile*, scores of rosettes from one plant closely aggregate to produce cushions.

The following grasses occur on ridges: *Danthonia stereophylla*, *Crinipes gynoglossa* and *Aristida galpinii* on outcrops and *Themeda triandra*, *Pentaschistis tysonii*, *Harpechloa falx*, *Eragrostis caesia*, *Aristida monticola*, *Cymbopogon validus*, *Danthonia disticha*, *Anthoxanthum ecklonii*, *Helictotrichum turgidulum* and *Stiburus alopecuroides* where soil conditions are more favourable. Accompanying these grasses is a number of herbs. They include *Scabiosa columbaria*, *Argyrolobium collinum*, *Tetraria cuspidata*, *Helichrysum adenocarpum*, *Vellozia viscosa*, *Euphorbia ericoides*, *Lobelia decipiens*, *Schizoglossum montanum* and *Scirpus falsus*.

(B) Vertical Outcrops

Vertical or nearly vertical outcrops occur on the flanks of long spurs leading to the main escarpment, for example the Organ Pipes Pass spur, and on buttress slopes of the main escarpment and its outliers. These outcrops are often arranged in horizontal tiers interrupted at intervals by grassland. Occasionally the outcrops take the form of cliffs, but usually they are too broken to be classified as such. In parts, the rock surface is dry, while in others it is moist or even dripping wet. The stages in the succession are as follows:—

(*a*) *Cryptogamic Stages*

The cryptogamic stages in the succession have not been studied in detail by the author. Algae coat wet rock surfaces. Mosses are fairly common. Schelpe (1953, p. 89) lists the following species: *Frullania* sp., *Campylopus trichodes*, *Grimmia pulvinata*, *Ptychomitrium cucullatifolium*, *Macromitrium tenue*, *Bartramia hampeana*, *Brachyhymenium dicranoides*, *Bryum alpinum*, *B. argenteum*, *Anoectangium wilmsianum* and *Thuidium promontorii.*

(*b*) *Herb and Dwarf Shrub Communities*

The three most important herbs contributing to mat formation are *Scirpus falsus*, *Vellozia viscosa* and *Crinipes gynoglossa.*

Scirpus falsus, a sedge about 4 in (10 cm) high, readily invades moist moss mats and forms dense carpets. It is frequently invaded by *Acidanthera* sp. (1490), *Athrixia fontana* and *Wahlenbergia undulata.*

Vellozia viscosa covers large areas of rock surface in the Subalpine Belt. It is a versatile species occurring in both moist and dry situations. *V. viscosa* is invariably accompanied by a much dwarfed *Cymbopogon validus.*

Crinipes gynoglossa is restricted to dry cliffs below 9,000 ft (2,743 m).

Species not inclined to form mats are numerous. Among the ferns are the ubiquitous *Mohria caffrorum* and *Pellaea quadripinnata.* Grasses include *Aristida galpinii*, *A. monticola*, *Pentaschistis oreodoxa*, *Koeleria cristata* and *Danthonia stereophylla*—all xeromorphic species. *Koeleria cristata* in this habitat, 6 in (15·2 cm) tall, glaucous-grey and extremely pubescent is hardly recognizable as one of the constituents of *Themeda triandra* Grassland. A rare grass on moist ledges is *Brachypodium bolusii*, a mesophytic species.

The monocotyledonous herbs present are chiefly geophytes. *Galtonia viridiflora*, an attractive liliaceous plant with pendulous greenish-yellow flowers is frequent in crevices and on ledges supporting a fair amount of soil. Also frequent in this habitat are *Scilla natalensis*, *Eucomis humilis* and to a lesser extent *Anthericum longistylum*, *Zantedeschia albomaculata* and *Eucomis bicolor*. The rare *Gladiolus flanaganii* is found in rock crevices at 9,000 ft (2,743 m). Several orchids are characteristic of the subalpine cliffs, namely *Disa fragrans*, *Holothrix thodei* and *H. scopularia.*

Dicotyledons are well represented and include dwarf shrubs, suffrutices, rosette plants, succulents and herbs. Dwarf shrubs present are *Osteospermum thodei*, *Berkheya rosulata*, *Stoebe vulgaris* and *Cliffortia spathulata.* Suffrutices include *Helichrysum sutherlandii*, *H. splendidum* var. *montanum*, *H. argentissimum*, *H. odoratissimum* and *Sutera pristisepala.* Among the

rosette plants present are *Helichrysum scopulosum*, *H. confertum* (Plate 28) and *Zaluzianskya pulvinata*. The rosettes of the two last named species are aggregated to form cushions. Succulents are represented by species of *Crassula*; *C. setulosa* var. *curta*, *C. umbraticola* and *C. muscosa* form small low-growing colonies in moist situations, while *C. sarcocaulis* a tall shrubby species is usually solitary. The remaining dicotyledons are *Oxalis obliquifolia*, *Scabiosa columbaria*, *Sebaea* sp. (1917), *Papaver aculeatum*, *Polygala hispida*, *Bupleurum mundtii*, *Pelargonium flabellifolium*, *Cyphia elata* and *Senecio inaequidens*.

At about 9,000 ft (2,743 m) on the Organ Pipes route there is a large overhang, dry over most of its area, but wet in one section of the floor where water drips from the roof. In the wet area are numerous moss mats some of which have almost completely given way to a community dominated by two minute plants *Aira caryophyllea* $1\frac{1}{4}$–$3\frac{1}{2}$ in (3·2–9 cm), a grass, and *Cotula tenella* $1\frac{1}{4}$ in (3·2 cm), a composite, with *Parietaria debilis*, a weak-growing fleshy stemmed urticaceous plant as an associate. The presence of *Aira caryophyllea* in the Drakensberg is interesting from a distribution point of view. According to Adamson (1950, p. 67) and Chippindall (1955, p. 86), *Aira caryophyllea* is probably an introduced species, but its distribution suggests that it occurs naturally in South Africa: the species has been recorded in the Cape Peninsula, Cathedral Peak, Mont aux Sources, the mountains of East Africa, the Mediterranean region and Europe. This is not an uncommon distribution for temperate species (see pp. 108–111 of the present work).

6.2.1.2. *The Climax*: Passerina–Philippia–Widdringtonia *Fynbos*

Fynbos is the climax community of the Subalpine Belt. Because of recurrent grass-fires it is limited in extent occurring in situations providing some protection from fire. The most extensive and best developed stands of fynbos are to be found on steep valley and escarpment slopes at the head of the main rivers, for example the Tseketseke, Indumeni, Mlambonja and Tugela (Plate 29) Rivers. Smaller stands occur in stream gullies and depressions on the Little Berg itself.

The community consists of shrubs between 3–10 ft (0·9–3 m) tall the majority of which are evergreen, though some may be deciduous. Most of the constituents have small leaves which are ericoid, elliptic or linear, variously coriaceous, and glossy or grey-lanate. Occasionally the leaves are pinnate. The density of the community varies considerably—from shrubs scattered in grassland to an almost impenetrable tangled mass of vegetation.

In South Africa such sclerophyllous vegetation is known as fynbos and is found chiefly in the south western Cape and on the eastern mountains. According to Bews (1925, p. 161) fynbos is ecologically equivalent to the macchia of the Mediterranean region. At first sight the presence of fynbos or macchia in a summer-rainfall area such as the Drakensberg may seem strange, because usually it occurs in winter-rainfall areas, for example the south western Cape, the Mediterranean region and the coastal parts of western and southern Australia. However, the two climatic areas have an important factor in common and that is a season of drought. Story (1952, p. 75) states that macchia is a more xerophytic type of vegetation than forest and is characteristic of regions subject to periods of drought (including physiological drought).

Fynbos in the Drakensberg can be either pure with one species dominant or mixed with several dominants (Plate 30). The most important dominants are probably *Passerina filiformis*, *Philippia evansii* and *Widdringtonia dracomontana*, hence the name *Passerina–Philippia–Widdringtonia* Fynbos given to Drakensberg fynbos.

Consociations in fynbos are formed by the following species:—

Passerina filiformis
Philippia evansii
Widdringtonia dracomontana
Passerina montana
Erica ebracteata
Macowania conferta
Buchenroedera lotononoides
Anthospermum aethiopicum
Rhus discolor
Buddleia corrugata
Protea dracomontana
P. subvestita
Syncolostemon macranthus
Calpurnia intrusa
Melianthus villosus

Shrubs which do not aggregate to any great extent include:—

Senecio haygarthii
Asparagus scandens
A. stellatus
Stoebe vulgaris
Euphorbia epicyparissias
Myrsine africana
Artemisia afra
Psoralea caffra
Polygala myrtifolia
Rhus dentata
Cliffortia spathulata
Royena hirsuta
Erica westii
Sphaeralcea pannosa
Berkheya draco
Helichrysum tenax
Lasiosiphon anthylloides

It is interesting to note that in fynbos *Helichrysum tenax* attains a height of nearly 8 ft (2·4 m) and, though shorter and less robust has a habit reminiscent of the arborescent *Senecio* species of East African mountains.

Very characteristic of fynbos is the cycad, *Encephalartos ghellinckii*. It is particularly abundant in the Tseketseke Valley.

Subordinate to the shrubs in dense fynbos is a layer of grasses and herbs. The three most constant species are probably *Polystichum* sp. (981), *Cymbopogon validus* and *Berkheya macrocephala*.

The remaining species are:—

Pellaea quadripinnata
Sticherus umbraculiferus
Festuca costata
Pentaschistis pilosogluma
Agapanthus campanulatus
Scilla natalensis
Eriospermum cooperi
Cyrtanthus erubescens
Anemone fanninii
Ranunculus cooperi (usually in wet places)
Gunnera perpensa
Alchemilla natalensis
Geranium pulchrum
Indigofera cuneifolius
I. longebarbata
Sebaea macrophylla
Diclis reptans
Helichrysum setosum
H. cooperi
H. umbraculigerum

Climbers include *Riocreuxia torulosa* var. *tomentosa*, *Dioscorea sylvatica* and *Clematis brachiata*.

Some of the more important fynbos dominants will be discussed individually:—

(*a*) *Passerina filiformis*.—This species is dominant in the upper reaches of the Indumeni Valley (Plate 31) and has been seen in association with *Calpurnia intrusa*, *Sphaeralcea pannosa*, *Syncolostemon macranthus* and *Philippia evansii* in the Ndedema Valley. It is a slender shrub about 4 ft (1·2 m) high with ericoid leaves. Its altitudinal range is between approximately 7,000–8,000 ft (2,133–2,438 m). Bews (1917, p. 561) describes *Passerina filiformis* as one of the most characteristic species of fynbos, but both Schelpe (1946) and West (1951) overlooked it in their surveys.

(*b*) *Philippia evansii*.—This species is fairly widely distributed on the Little Berg between 6,000–8,000 ft (1,829–2,438 m). It has already been mentioned as a constituent of *Cliffortia linearifolia* Scrub and *Leucosidea sericea* Scrub. *Philippia evansii* is abundant in the Tutumi Valley where it invades *Cymbopogon validus* Grassland or sometimes directly *Themeda triandra* Grassland and Temperate Grassland (Plate 32).

The plant attains a height of 8 ft (2·4 m) in sheltered places. It is more robust and virgate than *Passerina filiformis*. In the field it is possible to confuse this species with *Erica ebracteata*, but it can be distinguished quite easily by the sticky branches caused by secretion from stalked glands on the stems.

(*c*) *Widdringtonia dracomontana*.—This conifer invades grassland in gullies to form dense consociations. Its upper limit is about 8,500 ft (2,591 m). The community is very susceptible to fire damage.

(*d*) *Protea dracomontana*.—This recently described species is restricted to grassland on north-facing slopes above 6,600 ft (2,012 m). (See Plate 33). It is apparently the plant which Schelpe (1946, p. 71) called *P. abyssinica* and West (1951, p. 53) *P. hirta*. *P. dracomontana* consists of a large woody obovoid flat-topped, underground rootstock from which arise several usually simple erect stems with a maximum height of 4 ft (1·2 m). The plant seems to be irregularly deciduous.

Protea dracomontana is frequently co-dominant with *Buchenroedera lotononoides* and *Rhus discolor*. Associates include *Erica westii*, *E. woodii*, *Tetraria cuspidata*, *Selago* sp. (1637), *Indigofera woodii* and *Psoralea caffra*. In the absence of fire this community closes up and is invaded by other fynbos shrubs.

(*e*) *Protea subvestita*.—This is the rarest of the four *Protea* species in the Cathedral Peak area. It is a shrubby, slender-branched tree about 10 ft (3 m) high. Unlike *P. multibracteata* and *P. roupelliae* which have thick insulating bark and *P. dracomontana* which has an underground rootstock, *P. subvestita* appears to possess no fire-resisting features. It is not surprising, therefore, to find that it is restricted almost entirely to sheltered situations. *P. subvestita* forms dense fynbos sometimes in association with *Widdringtonia dracomontana*.

(*f*) *Buchenroedera lotononoides*.—This shrub is leguminous and about 3 ft (0·9 m) high with numerous erect slender stems and small grey-lanate leaves. Occurring between 6,000–9,000 ft (1,829–2,743 m) it is probably the most widespread shrub in the grassland on the Little Berg. As indicated above it frequently associates with *Protea dracomontana* and *Rhus discolor*. The densest stand of *Buchenroedera lotononoides* seen by the author is in the Ndedema Valley below the Sugar Loaf (Plate 34).

An interesting observation concerning *Buchenroedera lotononoides* has been made by Mr. U. W. Nänni, Forest Research Officer at Cathedral Peak. According to Mr. Nänni when *B. lotononoides* grows in grassland which is grazed by cattle, the area immediately surrounding the shrub is very closely cropped. He suggests as a possible explanation that *B. lotononoides* being a legume probably has root nodules containing nitrogen-fixing bacteria which enrich the soil and the result is a lush growth of grass which is selectively grazed by the cattle.

(*g*) *Clutia natalensis* and *Melianthus villosus*.—These two plants are both soft shrubs 4–5 ft (1·2–1·5 m) high and frequently occur together in fynbos in the lower part of the Subalpine Belt. They are often the first shrubs to invade Bracken Veld before the appearance of woody species such as *Athanasia punctata* and *Calpurnia intrusa* and in the lower ecotonal region, *Leucosidea sericea* and *Buddleia salviifolia*.

(*h*) *Buddleia corrugata*.—This plant is confined to the upper part of the Subalpine Belt above 8,500 ft (2,591 m). It is a much-branched shrub about 3–4 ft (0·9–1·2 m) high and forms fairly dense consociations commonly on scree. It is occasionally associated with *Passerina montana*. Schelpe (1946) does not record *Buddleia corrugata* for the Cathedral Peak area and it is clear that he did not distinguish it from *B. salviifolia* which has an upper limit of about 8,000 ft (2,438 m). The " *Buddleia salviifolia* " below the Organ Pipes Pass which Schelpe illustrates in Fig. 39 is definitely *B. corrugata*.

(*i*) *Rhus discolor*.—This deciduous shrub is 2–3 ft (0·6–0·9 m) tall with a large woody underground rootstock. It is widespread in *Themeda triandra* Grassland ascending up to about 8,000 ft (2,438 m).

The Status of Fynbos in the Subalpine Belt

In this account fynbos is treated as the climax community of the Subalpine Belt, but according to West (1951) and Acocks (1953) forest is the climax below 7,000 ft (2,133 m). If forest is climax one would expect to find relics up to 7,000 ft (2,133 m). The only relics present are at the very edge of the Little Berg, i.e. at the upper limit of the Montane Belt.

There are two factors which must be considered when trying to account for the absence of forest: the one is climate and the other soils. With increase in altitude the climate becomes more rigorous and inhospitable to forest. The effect of climate is clearly reflected in the increased xeromorphism of plants with increase of altitude. The presence in the soils of the Little Berg of the clay mineral montmorillonite, which produces certain unfavourable physical characteristics (described on pp. 5–8), may be antagonistic to forest. According to van der Merwe (1956, p. 1) trees do not normally occur on soils containing montmorillonite.

6.2.2. *Secondary Succession*

The only subseral areas in the Subalpine Belt are old salt-licks, roads and gardens.

Salt-licks are a few in number. They were probably established in the 1920's when the Little Berg was a public commonage. The salt-licks are very largely bare, but support several pioneer grasses chiefly *Eragrostis*

curvula, E. plana and *Cynodon hirsutus* var. *parviglumis.* Also present are *Panicum laevifolium, Digitaria ternata, Ficinia stolonifera, Helichrysum aureonitens, H. squamosum* and *H. caespitosum.* These plants eventually give way to *Themeda triandra.*

The lay-assistant's garden at the edge of the Little Berg which has been abandoned for five years contains the following species: *Brachiaria marlothii, Setaria pallide-fusca, Eleusine africana, Oenothera laciniata* and *Chenopodium schraderianum.* There are already signs that the garden is returning to *Themeda triandra* Grassland.

Roadsides are colonized chiefly by the creeping *Cynodon hirsutus* var. *parviglumis,* but also by *Eragrostis curvula.*

Chapter 7

THE ALPINE BELT

7.1. Introduction

The Alpine Belt occupies a narrow strip at the edge of the Drakensberg escarpment. The belt extends downwards into Natal to about 9,400 ft (2,865 m) and into Basutoland to about the same altitude. Alpine vegetation also occurs on outlying peaks such as Cathedral Peak, the Inner and Outer Horns and the Pyramid.

The geology and soils of the summit have already been described on p. 4. To recapitulate, the main facts are briefly as follows. The prevalent rock is basalt and it is exposed in numerous places to form horizontal outcrops and cliffs. The soils are turfy and never exceed 18 in (45·7 cm) in depth. During summer the soils become boggy and in winter they are subject to frost heaving. The surface of the soil is frequently covered with a sparse litter of small stones.

The climate of the Alpine Belt is severe and altitudinal drought conditions prevail, but unfortunately quantitative data to support this statement are almost completely lacking. The data available will have to be supplemented by what is known of the general characteristics of a high mountain climate.

With increasing altitude there is a decrease of atmospheric pressure and a resultant increase in intensity of insolation.

Associated with the increase in insolation is an increase in the intensity of ultra-violet rays. According to Daubenmire (1947, p. 223) the ultra-violet rays inactivate growth-promoting hormones and consequently check stem elongation. He states further that the great abundance of these wavelengths at high altitudes is believed to be the chief cause of dwarfness in alpine plants.

Increased insolation also induces high surface temperatures particularly in summer, when during the daytime the soil may be many degrees higher than the air temperature. On the other hand, because of the rarity of the atmosphere at high altitudes, soils cool very rapidly as soon as the sun goes down. The result is a wide range of soil temperature.

Air temperatures decrease with altitude, the rate being 0·9° F (0·5° C) per 328 ft (100 m) (Hann, 1903, p. 244). Frosts occur between the end of autumn and early spring. They can cause cold injury to plants, mechanical injury through frost heaving and physiological drought of the soil (see p. 75).

The only rainfall data available for the summit of the Drakensberg are for the Organ Pipes Pass rain-gauge at 9,600 ft (2,926 m). The mean annual rainfall is 63·52 in (1,609 mm). The beneficial effects of the high rainfall are very largely cancelled out by other factors of the climate.

Relative humidities are high during the wet season when there is an abundance of cloud, but low during the dry season and in early spring. Schelpe (1946, p. 79) recorded relative humidities as low as 4 and 23 per cent in spring during windy weather.

Under similar conditions of relative humidity, temperature and wind velocity, evaporation is much greater on mountains than at lower levels, because of the diminished pressure (Hann, 1903, p. 290).

Snow falls mainly during July and can lie for periods up to two months. The blanket of snow protects the plants from excessively low temperatures and prevents the soil beneath from freezing. It also adds to the supply of soil water. The presence of cavities in the snow cover has been referred to on p. 18.

High winds may occur at any season during the year, but are most common in late winter and spring. The winds often attain considerable velocity. They are important ecologically because they blow at a time when both soil moisture and the water-supplying power of the soil are low.

The vegetation of the Alpine Belt consists of climax heath communities dominated chiefly by low woody species of *Erica* and *Helichrysum* interspersed with alpine grassland dominated by species of *Festuca*, *Danthonia* and *Pentaschistis* (Plate 35). In addition there are hydroseral and lithoseral communities varying in extent.

The vegetation as a whole reflects the severity of the climate: most of the plants exhibit xeromorphic features of some kind. The heath constituents are evergreen dwarf shrubs with small ericoid, filiform or linear leaves. Species like *Erica* sp. (1728), *E.* sp. (1729) and *Passerina montana* have hard and more or less glossy leaves, while *Helichrysum trilineatum* var. *tomentosum*, *Euniorphia sericea* and *Athanasia thodei* have softer, grey-lanate leaves. The possession of a grey or white indumentum is a characteristic of many high mountain plants. The indumentum apparently reduces the amount of radiation absorbed. The grasses are mostly short with filiform leaves. Cushion plants are common, examples being *Helichrysum retortoides*, *H. scopulosum*, *H. milfordiae*, *H. splendidum*, *H. pagophilum*, *Muraltia saxicola* and *Zaluzianskya pulvinata*. Among the perennial rosette plants are *Berkheya multijuga*, *Cenia hispida*, *Ursinia montana*, *Hirpicium armerioides* subsp. *armerioides* and *Dianthus basuticus* subsp. *basuticus* var. *grandiflorus*.

Reduction in size of plants with increase of altitude is illustrated by several plants, the two most striking examples probably being *Ranunculus cooperi* and *Juncus exertus*. *Ranunculus cooperi* in the Subalpine Belt has peltate leaves up to 15 in (38·1 cm) in diameter whereas on the summit the maximum leaf diameter is 2 in (5·1 cm). *Juncus exertus* is 1 ft 6 in (45·7 cm) high at 6,100 ft (1,859 m), but only 2 in (5·1 cm) high at 9,800 ft (2,987 m).

The vegetation of the Alpine Belt is remarkably homogeneous. During May, 1961, the author walked along the summit from the Organ Pipes Pass to Mont aux Sources, a distance of about 40 miles (64 Km), and found very little variation in the vegetation.

7.2. Plant Succession

The suggested interrelationships of the communities in the hydrosere and lithosere are given in Fig. 10. The climax community is *Erica—Helichrysum* Heath.

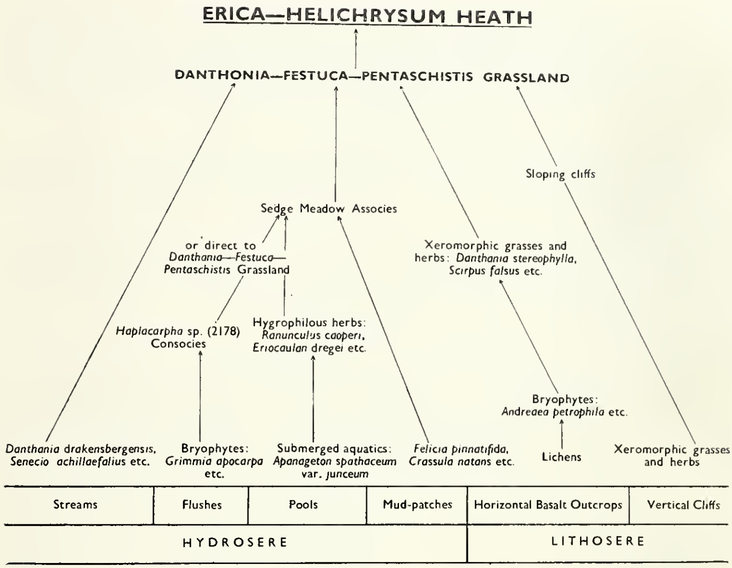

Fig. 10—Suggested interrelationships of the plant communities in the hydrosere and lithosere in the Alpine Belt

7.2.1. *Seral Stages*

7.2.1.1. *Hydrosere*

There are four primary areas in the hydrosere, namely flushes, pools, streams and mud-patches. The communities and the succession associated with these areas will be described in turn.

(a) Flush Communities

These communities occur over the " eyes " of streams and on horizontal slabs of basalt which receive a more or less continuous supply of water draining from the grassland on the slopes adjacent and above them. The flushes are characteristic of the whole of the summit area of the Natal Drakensberg and of some of the mountains in the interior of Basutoland. They show up as low, shiny green carpets of semi-aquatic vegetation.

Several mosses contribute initially to the formation of these carpets, the most important being *Grimmia apocarpa*. Eventually the mosses are succeeded by a community dominated by *Haplocarpha* sp. (2178) a rosette herb with spathulate leaves and yellow flowers (Plate 36). Associates include *Scirpus fluitans*, *Athrixia fontana*, *Agrostis huttoniae*, *Limosella longiflora*, *Eriocaulon dregei* and more rarely *Berkheya multijuga* and *Kniphofia caulescens*.

(*b*) *Pool Communities*

Permanent pools on the summit are rare, but temporary ones are common during summer. As already explained on p. 5, low-lying areas on the summit become spongy after rain and depressions are soon filled with water.

The only true aquatic present is *Aponogeton spathaceum* var. *junceum*, which occupies the centre of pools. A submerged aquatic, it presents an attractive sight in December with its white flowers floating on the surface of the water (Plate 37).

Several plants grow around the periphery of these pools, namely *Ranunculus cooperi* (dwarf form), *R. baurii*, *Senecio cryptolanatus*, *Eriocaulon dregei* and *Kniphofia caulescens*.

(*c*) *Streambank Communities*

The streams on the summit flow either into Basutoland or into Natal depending upon the aspect of the catchment. They are small, clear and frequently littered with grey boulders. The principal communities are formed by *Danthonia drakensbergensis*, *Kniphofia caulescens*, *Berkheya multijuga*, *Polygonum* sp., *Senecio achillaefolius*, *S. cryptolanatus*, *Juncus exertus*, *Euryops montanus*, *Moraea spathulata*, *Erica alopecurus*, *E. thodei* and the orchids *Neobolusia virginea* (on vertical banks) and *Satyrium fanniniae*. Also important is *Scirpus ficinioides*, a tall thick-culmed sedge about 3 ft (0·9 m) high, which is frequently dominant on small islands and on moist flats adjacent the streams. It is more abundant in the Langalibalele Pass and Mont aux Sources areas, where it occupies acres of moist ground.

(*d*) *Mud-patch Communities*

Scattered abundantly throughout alpine grassland are the mud-patches described on p. 5. The mud-patches are moist throughout summer, sometimes with ½ in (1·3 cm) of water, and in winter are subject to frost action. Several short plants form pure communities on these patches. They are: *Felicia pinnatifida* (Plate 38), *Psammotropha alternifolia*, *Crassula natans*, *Rhodohypoxis rubella*, *Limosella capensis* var., *L. longiflora* and *Juncus exertus* [a dwarf form only 2–4 in (5–10·2 cm) high]. Often associated with the dominants are *Moraea* sp. (2191), *Senecio tugelensis* and *Ranunculus cooperi* (dwarf form).

(*e*) *Alpine Sedge Meadow Associes*

This community, frequently intermediate in the hydrosere between three of the four communities already described and *Danthonia–Festuca–Pentaschistis* Grassland, is found on moist, but firm ground. The constituent plants form a close, continuous turf 2–4 in (5·1–10·2 cm) high.

The dominants are two sedges *Carex monotropa* and *C. killickii* (Plate 39). Important associates in order of abundance are *Sebaea thodeana*, *Geranium incanum*, *Schoenoxiphium filiforme*, *Trifolium burchellianum*, *Luzula faricana*, *Elsiea tysonii*, *Helichrysum subglomeratum*, *Moraea* sp. (1854), *Eragrostis caesia* and *Koeleria cristata*.

Occasionally this associes has a distinct hummock structure. There are two causes for this hummock formation. The first can be traced to the underground activity of a mole or mole-rat. The animal pushes up

soil from the sub-surface forming hemispherical mounds which are soon vegetated by the surrounding semi-aquatic vegetation (Plate 40). Distributional records suggest that the animal may either be *Chlorotalpa guillarmodii*, a true mole, or *Cryptomys natalensis natalensis*, a mole-rat. At this stage it is not possible to be more precise.

The second cause is trampling by cattle. This is apparently a fairly common cause of hummock formation in marshy areas in South Africa (see Killick, 1959, p. 23 and Martin, 1960, p. 311).

7.2.1.2. *Lithosere*

Primary rock areas can be classified into horizontal outcrops and vertical cliffs.

(A) Horizontal Outcrops

Horizontal basalt outcrops are fairly extensive in the Alpine Belt; they are usually found along the edge of the escarpment, adjacent streams and on the summit of high peaks.

(*a*) *Cryptogamic Communities*

The pioneers are crustaceous lichens, followed by foliose species. Dendroid lichens are surprisingly rare.

Mosses are the next cryptogams to enter the sere. The chief saxicolous species according to Schelpe (1953, p. 90) are *Andreaea petrophila*, *Campylopus trichodes*, *Grimmia commuta* var. *brevipes*, *G. drakensbergensis*, *G. pulvinata*, *Ptychomitrium cucullatifolium*, *Brachyhymenium dicranoides* and *Anoectangium wilmsianum*. On broken outcrops are *Encalypta ciliata*, *Macromitrium tenue*, *Bartramia hampeana*, *Bryum argenteum* var. *lanatum*, *Fabronia perciliata* and *Thuidium promontorii*.

(*b*) *Xeromorphic Herbs*

Next is a stage of xeromorphic herbs the most important being *Danthonia stereophylla*, a wiry tufted grass closely related to and previously confused with *D. drakensbergensis*, a streambank species.

Scirpus falsus (dwarf form) also occupies fairly extensive areas usually rather moister than *D. stereophylla*. It is particularly common on the south-east slopes of Cleft Peak.

Two semi-woody plants which form cushions on rock surfaces are *Helichrysum retortoides* and *Muraltia saxicola*. The remaining herbs are *Pellaea calomelanos*, *Eragrostis caesia*, *Bulbostylis humilis*, *Psammotropha mucronata*, *P. alternifolia*, *Crassula muscosa*, *Oxalis obliquifolia*, *Erica frigida*, *Glumicalyx montana*, *Ursinia montana*, *Helichrysum setigerum* and *H. alticolum* var. *montanum*. These plants frequently occur as chasmophytes.

The herb communities are superseded by *Danthonia–Festuca–Pentaschistis* Grassland.

(*c*) Danthonia–Festuca–Pentaschistis *Grassland*

The grassland on the summit of the Drakensberg possesses an irregular physiognomy: in parts it is low, even and turfy, while in others it is fairly tall, uneven and open. Everywhere the grassland is interrupted by mud-patches (Plate 35).

The dominants are three grasses belonging to temperate genera, namely *Danthonia disticha*, *Festuca caprina* and *Pentaschistis oreodoxa.* They occur in associes or consocies. All three grasses are xeromorphic and become dormant during the winter months. *Danthonia disticha* and *Festuca caprina* are very densely tufted and have filiform leaves. There seem to be two forms of *Danthonia disticha* on the summit, the one rather tall and lax and the other dwarf with the old leaves pronouncedly recurved. *Pentaschistis oreodoxa* has short, flat, hairy leaves which recurve with age. It seems to prefer stony areas of the summit.

Grass associates are *Koeleria cristata*, *Harpechloa falx*, *Poa binata*, *Eragrostis caesia* and *Anthoxanthum ecklonii*—a meagre number of species when compared with the grasslands of the lower belts.

Forbs are more abundant than imagined by previous workers, for example Schelpe (1946) and West (1951). Unfortunately it was not possible for the author to collect on the summit during August and September, otherwise the following list indicating time of flowering is fairly representative:—

October

Moraea sp. (1854)	*Aster natalensis*
Gnidia aberrans	*Helichrysum argentissimum*
Sebaea thodeana	*H. retortoides*
Muraltia saxicola	

November, December

Moraea spathulata	*Geum capense*
M. spp. (1854, 2182 and 2184)	*Lotononis galpinii*
Elsiea tysonii	*Thesium* sp. (1883)
E. flanaganii	*Gnidia aberrans*
Kniphofia caulescens	*Valeriana capensis*
K. northii	*Euryops evansii*
K. sp. (1857)	*Senecio barbellatus*
Neobolusia virginea	*S. gramineus*
Dianthus basuticus subsp. *basuticus* var. *gracilis*	*Helichrysum flanaganii*
Heliophila suavissima	*H. argentissimum*
H. sp. (1875)	*Aster natalensis*
	Eumorphia sericea

January–March

Dierama igneum	*Diascia* sp. (1499)
Moraea culmea	*Wahlenbergia montana*
Disa fragrans	*W. undulata*
Brownleea macroceras	*W.* sp. (2334)
Satyrium neglectum	*Helichrysum argentissimum*
Monadenia basutorum	*H. setigerum*
Corycium nigrescens	*Senecio tugelensis*
Cerastium dregeanum	*S. cryptolanatus*
Psammatropha alternifolia	*Berkheya multijuga*
Crassula setulosa	*Athrixia angustissimum*
Lessertia thodei	*Hirpicium armerioides* subsp. *armerioides*
Lotononis galpinii	*Cenia hispida*
Alepidea thodei	
Erica alopecurus	

April, May

Oxalis obliquifolia	*Helichrysum odoratissimum*
Scabiosa columbaria	*H. subglomeratum*
Hirpicium armerioides subsp. *armerioides*	*H. adenocarpum*
Ursinia montana	*Gymnopentzia bifurcata*

July

Helichrysum odoratissimum

From the above list it will be seen that summer to early autumn is the period of maximum profusion of alpine forbs. In spring and late autumn there is very little in flower and in winter practically nothing. Schelpe (1946, p. 89) states that in September, a spring month, almost the only plant in flower in quantity is *Hesperantha modesta*.

Many of the forbs form conspicuous and sometimes large socies in grassland. *Moraea spathulata* is perhaps the most striking plant on the summit in summer (Plate 41). An iridaceous plant about 3 ft (0·9 m) high, with large yellow flowers, it forms dense socies in the Tsanatalana Valley. *Euryops evansii* is the tallest plant in the Alpine Belt, sometimes attaining a height of 4 ft (1·2 m). In winter after a heavy snowfall it is frequently the only plant visible above the surface of the snow (Plates 42 and 43).

Berkheya multijuga is common in moist parts of the grassland, likewise the red and white-flowered *Kniphofia caulescens*.

During January and February the orchids are a prominent feature of the flora. They include *Disa fragrans*, *Satyrium neglectum*, *Brownleea macroceras*, *Corycium nigrescens* and *Monadenia basutorum*.

Grey socies of *Helichrysum* are common, the principal species being *H. argentissimum*, *H. odoratissimum* and *H. flanaganii*.

Plants occurring casually without aggregating include *Dierama igneum*, *Gladiolus longicollis*, *Elsiea tysonii*, *E. flanaganii*, *Cerastium dregeanum*, *Dianthus basuticus* and *Senecio tugelensis*.

In the passes leading to the summit, for example the Organ Pipes Pass, several grasses and forbs occur in *Danthonia–Festuca–Pentaschistis* Grassland which are not normally found on the summit. These plants include the grasses *Aristida monticola* and *Brachypodium flexum*, the monocotyledons *Huttonaea grandiflora*, *Eucomis bicolor* and *E. humilis* and the dicotyledons *Bupleurum mundtii*, *Diascia* sp. (1488), *Lobelia preslii*, *Senecio macroalatus* and *S. bupleuroides*.

Between 8,000–9,200 ft (2,438–2,743 m) on the Basutoland side of the escarpment, i.e. adjacent to *Danthonia–Festuca–Pentaschistis* Grassland, *Themeda triandra* appears again, frequently in pure stands. The grass has short recurved leaves and becomes intensely red during autumn. Accompanying *Themeda triandra* are *Koeleria cristata* and *Harpechloa falx*, and in disturbed areas *Cynodon hirsutus* var. *parviglumis* and *Catalepis gracilis*.

(B) Vertical Cliffs

The basalt cliffs of the main escarpment up to 1,500 ft (457 m) high in parts present a variety of rock habitats—sheer faces, crevices, pockets, ledges, overhangs and moist areas near waterfalls. Owing to the inaccessibility of these cliffs it is not possible to present an adequate picture of the cliff vegetation.

Much of the rock surface is bare but a considerable portion is covered with alpine grassland and occasionally alpine heath. Species common on the cliffs are *Danthonia stereophylla*, *Vellozia viscosa*, *Helichrysum splendidum* var. *montanum*, *H. scopulosum* and in moist sheltered situations *Ranunculus cooperi*, *Galtonia viridiflorum* and the attractive red-flowered *Gladiolus flanaganii*.

Small cliffs on the summit plateau support *Danthonia stereophylla*, *Helichrysum milfordiae*, *H. pagophilum* and *Psammotropha alternifolia*. At their base are distinct communities formed by *Kniphofia northiae*, *K.* sp. (1857), *Cyrtanthus flanaganii* and *Zaluzianskya longiflora*, usually mixed with alpine grasses. *H. milfordiae* often occurs on horizontal slabs of basalt at the base of small cliffs.

Overhangs contain their own characteristic flora. Usually this habitat is damp and shaded. The floors are frequently covered with the thalli of *Plagiochasma* sp., tufts of *Bryum argenteum* var. *lanatum* (Schelpe, 1953, p. 90) and herbaceous plants such as *Helichrysum milfordiae* which forms extensive carpets with *Crassula* sp. (2321) growing up between the grey rosettes, *C. harveyii*, *Ranunculus cooperi* (dwarf form), *Zaluzianskya longiflora* and the fern *Woodsia burgessiana*. The walls support the mosses *Webera depauperata* and *Fissidens latifolius* (Schelpe, l.c., p. 90).

7.2.2. *The Climax:* Erica–Helichrysum *Heath*

This is the climax community on the summit of the Drakensberg. The community consists of dwarf shrubs 6–24 in (15·2–60·9 cm) high. The term heath is used in preference to fynbos or macchia since it connotes a much shorter community. Warming (1909, p. 210) defines heath as a " treeless tract that is mainly occupied by evergreen slow-growing, small-leaved dwarf shrubs and creeping shrubs which are largely Ericaceae (ericaceous heath) ". But for fire, heath would probably occupy greater areas of the summit.

The dominants which cover the largest areas of the summit belong to the genera *Erica* and *Helichrysum*, hence the name *Erica–Helichrysum* Heath. Two consociations and three associations make up the community.

(*a*) Erica *sp.* (1728) *Consociation*

This consociation which equals Schelpe's *Erica* sp. nov. (71, 72) Community is the most extensive of the heath communities. The dominant, *Erica* sp. (1728), is a dwarf shrub 6–18 in (15·2–45·7 cm) high with minute leathery, closely adpressed leaves. The plant has an olive-green appearance and attains full flower in October. Occurring on level portions of the summit it forms fairly dense communities invariably interspersed with alpine grasses.

Other constituents of this consociation are *Helichrysum trilineatum* var. *tomentosum*, *Erica rigida*, *E.* sp. (1729), *E. flanaganii*, *Chrysocoma tenuifolia*, *Thesium imbricatum*, *Cliffortia browniana*, *Gnidia polystachya* var. *congesta*, *Lotononis galpinii*, *Clutia nana*, *Euryops acraeus* and *Anthospermum hispidulum*. All these shrubs are dwarf and sclerophyllous.

(*b*) Erica-Helichrysum *Association*

This is a common association usually found above 10,500 ft (3,200 m) (Plates 35 and 44). The dominants are *Erica* sp. (1728) and *Helichrysum trilineatum* var. *tomentosum.* Casual constituents are as in the preceding community.

(*c*) Erica *sp.* (1729) *Consociation*

Erica sp. (1729 = Schelpe 616) forms a pure type of heath on broken promontories at the edge of the summit plateau, a habitat which provides a certain amount of shelter and is fairly moist. This *Erica* is slightly taller than *E.* sp. (1728), darker green in colour and the leaves are longer and patent instead of adpressed.

(*d*) Helichrysum–Passerina *Association*

This community appears to be limited in extent: the author has only seen it at the edge of the escarpment near Castle Buttress (Plate 45). The dominants are *Helichrysum trilineatum* var. *tomentosum* and *Passerina montana.* The habitat is broken, hence the presence of *Danthonia stereophylla*, a common summit lithophyte.

(*e*) *Boulder-field Heath*

Situated on the summit are fairly large areas supporting boulders varying in their density of aggregation. The habitat is stable and not to be confused with scree. The heath growing in this habitat is 2–4 ft (0·6–1·2 m) tall and sometimes quite dense. The tallness of this heath as compared with the other heath types is probably due to the protection from fire afforded by the boulders.

The dominants are three composites *Athanasia thodei*, *Helichrysum trilineatum* var. *tomentosum* and *Eumorphia sericea* with *Danthonia drakensbergensis* and other alpine grasses filling the intervening gaps (Plate 46).

Two ferns often grow in the shade of the boulders, namely *Dryopteris pentheri* (a depauperate, high-altitude form) and *Woodsia burgessiana.*

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Chapter 8

LITERATURE

A review of previous work on the vegetation of the Drakensberg has been deliberately left till now, because it was felt that a more critical appreciation could be made after the author's description of the vegetation.

Studies on the vegetation of the Drakensberg have been made by Thode (1894, 1901), Galpin (1909), Bews (1917, 1918), Markötter (1930), Schelpe (1942–43, 1946, 1953), West (1951) and Acocks (1953). These studies will be discussed in chronological order.

8.1. Thode (1894, 1901)

Thode was probably the first botanist to describe the vegetation of the Drakensberg. He lived for a number of years in the Loteni area south-west of Giants Castle and collected as far north as Muller's Pass. He had an intimate knowledge of the flora which is reflected in his two papers, both floristic accounts, the latter a condensed English version of the former in German.

Thode divided the Mountain Region into two sub-regions viz. the Lower Mountain Region between 4,500–7,000 ft (1,372–2,133 m) and the Upper or Subalpine Mountain Region between 7,000–10,000 ft (2,133–4,572 m). He based this division on " general aspect of the vegetation or floral physiognomy ". Thode's regions correspond more or less with those of West (1951) and Acocks (1953) (Table 11).

(*a*) *Lower Mountain Region*

Thode typified this region by the presence of *Leucosidea sericea, Protea* spp. and the tree fern *Cyathea dregei.* In all he encountered 208 genera. Unfortunately Thode completely ignored the grasses and sedges.

(*b*) *Upper Mountain Region*

This region is typified by *Helichrysum* spp. and *Erica* spp. Thode describes very graphically the scenery of the summit and refers to the extremities of the climate. He states (1901, p. 14) that the summit supports " patches of stunted vegetation not more than 1–3 ft high with a veritable flower-garden of mostly sociable herbaceous plants between them . . .". He cites 63 genera and emphasizes the importance of composites.

8.2. Galpin (1909)

Galpin explored the southern parts of the Drakensberg in 1904. He climbed Doodmans Krans (not traceable on maps, but probably near Lehana Pass), the Satsanna Berg [Tsatsana Berg, 9,675 ft (2,950 m)] and Ben McDhui [9,846 ft (3,000 m)] on the Witteberg. His description of the vegetation of these mountains, purely floristic in content, suggests that the vegetation is not very different from that of the Cathedral Peak area about 150 miles (241 Km) north-east. Galpin listed 349 species of which at least 148 occur in the Cathedral Peak area. It is not possible to give the exact proportion since Galpin's plants were not all named to species.

Certain species seem to be more abundant in the southern Drakensberg than in the Cathedral Peak area. For example, Galpin (p. 210) refers to " masses of *Arundinaria tesselata* ", the Berg Bamboo, and " fields of *Bromus firmior* " (now *B. speciosus*).

TABLE 11.—Zonation of vegetation in the Drakensberg according to various workers

metres	Thode (1894, 1901)	Schelpe (1942–1943)	Schelpe (1946, 1953)	West (1951)	Acocks (1953)	Killick	feet
3,500		High Altitude Vegetation	Alpine *Erica* Formation (1946) Subalpine *Erica* Zone (1953)	Alpine Formation	*Themeda–Festuca* Alpine Veld	Alpine (Heath) Belt	11,000 10,000
3,000 2,500	Upper or Subalpine Region (*Helichrysum* spp. and *Erica* spp.)		Fynbos Formation (1946) Fynbos Zone (1953)			Subalpine (Fynbos) Belt	9,000 8,000 7,000
2,000 1,500	Lower Mountain Region (*Protea* spp. and *Cyathea dregei*)	Low Altitude Vegetation	Montane Forest Formation (1946) Montane Forest Zone (1953)	Evergreen (Mountain) Forest Formation	Highland Sourveld	Montane (Forest) Belt	6,000 5,000
1,000					Southern Tall Grassveld		4,000 3,000

Galpin makes one statement (p. 209) which can be queried and that is that *Festuca caprina* remains green during winter. In the author's experience the grass becomes dormant and adds to the tawny-grey aspect of alpine grassland during winter.

8.3. Bews

8.3.1. (1917)

Bews was the first to study the plant ecology of the Drakensberg. His observations were made in the Goodoo Pass, Van Reenen's Pass and Mont aux Sources areas. This first paper includes a description of the topography, geology, soils, climate and the vegetation.

At first Bews considered dividing the mountain region into two zones the boundary between being the upper limit of tree growth, i.e. about 7,000 ft (2,133 m). However, he did not adopt this scheme, because he found communities of the lower zone, for example tussock veld and cliff vegetation, also occurring in the upper zone.

Bews distinguished ten formations, namely the Veld Formation, *Protea* Veld Formation, Rocky Scrub Formation (*Greyia sutherlandii*), Scrub Formation (*Leucosidea sericea*), Bush Formation (*Podocarpus* spp.), Stream-bank Vegetation, Vlei Formation, Vegetation of the Mountain Top, Cliff Vegetation and Fynbosch or Maquis. He described these formations in some detail and discussed their successional relationships. Bews recognized only one climax, namely Bush.

The main inaccuracies in Bews's paper concern the Vegetation of the Mountain Top and Fynbosch.

Many of the plants Bews lists for Top of the Mountain Vegetation are strictly below-summit species, for example *Erica woodii*, *E. caffrorum*, *E. oatesii*, *Helichrysum fulgidum*, *H. cooperi*, *H. randii*, *H. aureonitens*, *Guthriea capensis*, *Wurmbea kraussii*, *Commelina africana* and *Carex drakensbergensis*. No grass species are mentioned.

In describing the Fynbosch Formation, Bews (p. 561) states: " it has many species in common with the mountain-top vegetation ". In the author's experience the only species in common is *Passerina montana*, which has a very wide vertical distribution occurring between 4,500–10,000 ft (1,372–3,048 m).

8.3.2. (1918)

Here Bews (pp. 138–140) described the Mountain Tussock Veld occurring between 4,000–8,000 ft (1,219–2,438) m). This community agrees in detail with his Veld Formation (1917).

8.4. Markötter (1930)

This work consists of an enumeration of the plants collected by Thode in the Witzieshoek, Oliviershoek and Koolhoek areas between 1891–1914. The plant list of 489 species is preceded by a brief description of the climate and vegetation. Markötter paid special attention to the life-forms of the Drakensberg plants.

8.5. Schelpe

8.5.1. (1942–43)

In this paper Schelpe described very briefly the plant ecology of the Cathedral Peak area. He divided the vegetation into two belts, viz. Low Altitude Vegetation between 4,600–8,000 ft (1,402–2,438 m) and High Altitude Vegetation between 8,000–11,000 ft (2,438–3,353 m).

(*a*) *Low Altitude Vegetation*

Schelpe described the chief communities of this belt, namely *Themeda* Grassland, *Pteridium* Consocies, *Protea* Veld, *Greyia–Aloe* Associes, *Leucosidea sericea* Scrub and *Podocarpus* Forest, designating the last-named community as the climax. If *Podocarpus* Forest is the climax of the whole of this belt one would expect to find forest relics up to 8,000 ft (2,438 m) instead of only below 6,000 ft (1,829 m).

(*b*) *High Altitude Vegetation*

In this belt Schelpe described the *Polystichum* Consocies, Alpine Mat Associes, *Festuca* Grassland and Alpine Grassland (no species cited) with the *Erica* Consociation as climax in exposed parts and *Buddleia corrugata* (not *B. salviifolia* as given by Schelpe) as climax in gullies.

Although Schelpe (p. 25) recognized what he called "Alpine Vegetation" consisting of Alpine Grassland and the *Erica* Consociation, he did not distinguish it from the vegetation occurring below the summit to 8,000 ft (2,438 m)—a region with different grassland types and a climax of its own, viz. subalpine fynbos, which differs in both composition and physiognomy from the *Erica* Consociation. Apparently Schelpe at this stage had not encountered fynbos proper: he had seen *Buddleia corrugata*, a comparatively unimportant constituent of fynbos, but not the sclerophylls like *Passerina filiformis*, *Philippia evansii* and *Erica ebracteata*.

8.5.2. (1946)

In this work, an unpublished thesis, Schelpe made what is to date the most detailed study of the plant ecology of the Drakensberg. Schelpe investigated the area between Cathedral Peak and Indumeni Dome. His work has been much quoted in the present study, so it will only be necessary to review it very broadly here.

This time Schelpe recognized three formations instead of two, namely the Montane Forest Formation between 4,700–6,000 ft (1,433–1,829 m), the Fynbos Formation between 6,000–9,700 ft (1,829–2,957 m) and the Alpine *Erica* Formation between 9,700–11,000 ft (2,957–3,353 m). From Table 11 it will be seen that except for small differences in altitude Schelpe's formations co-incide with the belts of the present author. In the main his communities correspond as well. The work is supplemented by a check-list of 548 species.

Possibly the chief shortcoming of Schelpe's work is his neglect of the grass communities. He overlooked *Pentaschistis tysonii* Grassland and the *Danthonia macowanii* Consocies, both extensive communities, and gave a very inadequate picture of the composition of all the grassland types.

8.5.3. (1953)

In this publication Schelpe described the bryophyte communities of the Natal Drakensberg. By way of introduction he restated his 1946 classification of the vegetation, this time substituting the term zone for

formation and changing the name of the uppermost belt from Alpine *Erica* Formation to Subalpine *Erica* Zone. No reasons were given for these changes.

8.6. West (1951)

West studied the vegetation of the Weenen County of which the Drakensberg area between Giants Castle and Mont aux Sources is a part. His studies of the Drakensberg vegetation, however, were mainly concentrated in the Giants Castle–Cathkin area. Before describing the vegetation, West gave an account of the history of the Weenen County and discussed the factors of the environment.

West divided the mountain region into two climax formations, namely the Evergreen (Mountain) Forest Formation between 3,500–7,000 ft (1,067–2,133 m) with Grassland as a fire subclimax and the Alpine Formation between 7,000–11,500 ft (2,133–3,505 m).

Like Schelpe (1942–43), West regarded Forest as the climax of the Little Berg, but up to 7,000 ft (2,133 m) instead of 8,000 ft (2,438 m). West states several times that there are numerous patches of relic forest on the Little Berg. In point of fact there are very few patches and they are situated only near the edge of the Little Berg at 6,000 ft (1,829 m).

Like Schelpe (1942–43), West did not separate the vegetation of the summit from that of the sub-summit. In Schelpe's case this was because he had not yet encountered subalpine fynbos, whereas in West's case it was because he had not encountered alpine heath. West (p. 50), in his description of the summit, states " the macchia shrubs probably excluded by periodical fire are conspicuously absent ". The present author visited the Bushmans Pass area in 1953, where West studied the summit vegetation, and confirmed the absence of shrubs. The Bushmans Pass area seems to be more densely populated by Basutos and their stock than in other areas along the summit, hence the greater frequency of fires.

West's statement concerning the absence of shrubs on the summit caused Story (1952, p. 33) to write: " It may well be, however, that the highest parts are out of the macchia zone and if so, West's alpine grassveld is not a subclimax, but a climax ". From observations made by the present author in the Sani Pass and Indumeni Dome—Mont aux Sources areas, dwarf shrubs are present even on the highest peaks, consequently alpine heath and not grassland is climax.

8.7. Acocks (1953)

The mountain region falls within three of Acock's vegetation types viz. Southern Tall Grassland between 3,500–4,500 ft (1,067–1,372 m), Highland Sourveld between 4,500–7,000 ft (1,372–2,133 m) and *Themeda–Festuca* Alpine Veld above 6,000–7,000 ft (1,829–2,133 m).

(*a*) *Southern Tall Grassveld* (*Type* 65)

Acocks describes this type as consisting of an open savanna of *Acacia woodii* in sourish mixed grassland containing plentiful patches of *Hyparrhenia* species with scrub forest on southern and eastern aspects.

Applying Acock's altitudinal limits only the lowest parts of the river valleys below 4,500 ft (1,372 m) should support Southern Tall Grassveld. In actual fact, however, *Hyparrhenia* Grassland occurs right up to 6,000 ft (1,829 m).

(*b*) *Highland Sourveld* (*Type* 44*a*)

Acocks states that probably the whole of the Highland Sourveld area was originally forest and scrub forest dominated by *Podocarpus latifolius* and *Leucosidea sericea* respectively. If one accepts the naturalness of the fire factor discussed on p. 36 of the present work, it is difficult to believe that any part of the Drakensberg was once covered by such forest—at least not since the climate included a dry winter season. And, as pointed out on p. 83, if forest was the climax of the whole of the Highland Sourveld area, one would expect to find forest relics throughout its whole width instead of only below about 6,000 ft (1,829 m). In any case, it is probable that the climate of the Subalpine Belt is hostile to forest.

Acocks gives the relative abundance of the constituent species of forest, scrub forest and *Themeda triandra* Grassland. The only tall grass which he mentions in *Themeda triandra* Grassland is *Hyparrhenia hirta*, which is surprising, because tall grasses like *Hyparrhenia hirta*, *Miscanthidium capense* and *Cymbopogon validus* are generally accepted (c.f. Bayer, 1955, p. 545, and others) as seral concomitants of forest.

(*c*) Themeda–Festuca *Alpine Veld* (*Type* 58)

According to Acocks this veld type consists of *Themeda triandra* Grassland with a high proportion of *Festuca* species and other grasses of a southern affinity occurring at higher altitudes, relic patches of *Leucosidea sericea* Scrub and Fynbos composed of *Passerina montana*, *Erica woodii*, *E. drakensbergensis*, *E. ebracteata*, *Encephalartos ghellinckii* and *Widdringtonia dracomontana*.

Like West (1951) and Schelpe (1942–43), Acocks failed to recognize the distinctness of the summit vegetation. He did not realize that the " grasses of a southern affinity " become dominant on the summit to the complete exclusion of *Themeda triandra*, and that the summit supports as climax not fynbos but low alpine heath.

Chapter 9

BIOTIC FACTORS

9.1. Man

9.1.1. *Utilization of Indigenous Flora*

9.1.1.1. *Kraal Construction*

In the construction of kraals mainly indigenous plants are used. Some of these plants are rare or no longer grow in the Bantu locations because of cultivation and overgrazing, so that the Bantu are forced to obtain them from the Forest Reserve where they grow in comparative abundance. The Bantu visit the Forest Reserve chiefly in May and June and buy bundles of the necessary grasses and other plants at 5 cents (6d.) per bundle. During May, 1955, 1,369 bundles were sold bringing in a revenue of R68.45 (£34. 4s. 6d.).

The hemispherical framework of a Bantu hut is made up of hundreds of saplings or straight branches of forest species or *Acacia mearnsii*, the wattle. Fourcade (1889, p. 48) states: " fully a thousand wattles are required on an average for the construction of each hut ". The sticks are tied together with *Danthonia macowanii* (u-Hashu), a streambank grass growing on the Little Berg (Plate 19).

Thatch, consisting of species of *Hyparrhenia* (i-Ngca), *H. hirta*, *H. aucta* and *H. tamba*, is placed over the framework and is held in place by two types of net. The first has a vertical component consisting of plaited *Hyparrhenia* and a horizontal one of woven leaves of *Hypoxis* sp. (3443, in-Komfe), and the second has both the vertical and horizontal components consisting of *Danthonia macowanii*, with diagonals of *Hypoxis* sp. (3443). See Plate 47. The net is weighted down with one or two circular bases made of *Widdringtonia dracomontana*, a shrub possessing apparently very flexible wood.

The door frames are variously made, usually of wood covered with *Danthonia macowanii*, for example the one shown in Plate 47. Distinctive patterns are often worked in above the doorway. They involve the use of *Eragrostis curvula* (um-Vithi), *Danthonia macowanii* or *Hypoxis* sp. (3443).

Surrounding groups of huts or immediately near their entrance is a palisade or windshield (Plate 48). The framework consists of *Acacia mearnsii* and supports culms of *Miscanthidium capense* var. *villosum* (isi-Thala), *Phragmites communis* (um-Hlanga) and *Hyparrhenia glauca* (u-Qungwa) cut to equal lengths, 6–7 ft (1·8–2·1 m) high, and arranged vertically. The culms are attached to the framework by cord made of *Danthonia macowanii*. These palisades have to be renewed every two or three years.

Bantu prefer a living fence which is durable and can withstand fire to one composed of dead timber, hence they plant truncheon cuttings of trees which strike root easily. In the Drakensberg area *Greyia sutherlandii* is commonly used.

9.1.1.2. *Domestic Articles*

(*a*) *Basins* (isi-Hlele).—These (Plate 49) are made of *Danthonia macowanii* reinforced vertically with a grass which the Bantu call u-Vinde, but which the author has never seen in flower. u-Vinde is a tufted grass

with long, wiry leaves and grows in moist gullies in the Mlambonja Valley. It has the habit of a *Festuca*, but can be distinguished quite easily from the known South African species by the presence of a conspicuous membranous ligule about ¼ in (7 mm) long.

(*b*) *Sleeping Mats.*—*Scirpus ficinioides* (i-Ncema) and *Typha capensis* (i-Buma plama), chiefly the former, are used in the construction of sleeping mats (Plate 49). Nowadays the mats are sewn with string, but previously *Danthonia macowanii, Agave americana* and a plant which the natives call u-Boko were used.

(*c*) *Maize Baskets* (isi-Lulu).—These (Plate 49) consist of horizontal aggregations of species of *Hyparrhenia* sewn together vertically with u-Vinde. Smaller baskets are made for storing beans.

(*d*) *Beer Sieves* (isi-Vovo).—This article, used for filtering Bantu beer, is made of u-Vinde reinforced horizontally with *Scirpus ficinioides* (Plate 49). The coloured patterns on the outside are effected with dyes.

(*e*) *Down.*—The inflorescence of *Typha capensis* is used as down to fill pillows and cushions.

(*f*) *Cups.*—Cups are sometimes made from the roots of i-Ntana, which the Bantu say is a small shrub. Bews (1920, p. 465) gives in-Tana as the Zulu name for *Dioscorea cotinifolia;* in the Drakensberg the name may refer to the local species, *D. sylvatica.*

9.1.1.3. *Medicinal*

The chief medicinal use of plants in the Drakensberg seems to be as emetics. The following plants are used for this purpose:—

Anemone fanninii (u-Manzamnyama)—roots.
Cymbopogon validus (isi-Qungwa)—extreme base of culms.
Myrica serrata (u-Makhuthula)—bark.
Pterocelastrus sp. (1730) (u-Sehlulamanye)—bark.
Rapanea melanophloeos (u-Maphipha)—bark.
Tylophora flanaganii (in-Hlanhla)—stems.

Also used for stomach troubles, the exact nature of which cannot be readily determined from the Bantu, is the bark of *Maytenus acuminatus* (um-Lulama), the leaves and petioles of *Eriospermum cooperi* and the roots of *Pentanisia prunelloides* (i-Cimamlilo).

Gunnera perpensa (u-Gobho) is used for retained afterbirth in cattle and humans. The rhizome is crushed and then boiled in water.

The leaves of *Satureia grandibracteata* (um-Hlonyana) are bruised and inserted in the nostrils of humans to prevent colds. This labiate is strongly aromatic having a distinct menthol-like smell. A decoction of crushed leaves of *Senecio serratuloides* (in-Sukumbili) is used in the treatment of influenza, also the roots of *Alepidea amatymbica* (i-Khathazo).

9.1.1.4. *Miscellaneous*

(*a*) *Reins, cord and thread.*—The use of *Danthonia macowanii, Hypoxis* sp. (3443) and *Eragrostis curvula* as cord and thread has already been mentioned. Another plant used for its fibre is *Dierama robustum* (i-Thembu), but this plant is not very common in the Cathedral Peak area. The Bantu say it has the strongest fibre available locally.

Two plants known only by their Zulu names are occasionally used. They are in-Tozwane and u-Boko. Zulu dictionaries (e.g. Bryant, 1905) give in-Tozwane as the Zulu name for certain members of the Thymelaeaceae whose bark is used as fibre.

(*b*) *Soap.*—The bulbs of *Scilla natalensis* (in-Guduza), a common geophyte, are cut up and used as soap for washing clothes.

(*c*) *Ink.*—The berries of *Rubus ludwigii* are crushed, water is added and the resultant liquid, red in colour, is used as ink by some of the more literate Bantu.

(*d*) *Fire-making.*—The wood of *Halleria lucida* (i-Minza) is said to produce efficient friction stick.

(*e*) *Rain-making.*—Killick 1227, an umbelliferous shrub (um-Phondovu), which grows along streambanks on the Little Berg, is used by Bantu witch-doctors for " making rain ". According to the Bantu it is used only in the event of very serious drought because it has unpredictable results. On occasions they say it has induced severe hail-storms and sometimes even snow.

(*f*) *Assegaais.*—The Bantu use *Halleria lucida* for making assegaai shafts.

(*g*) *Walking-sticks.*—*Maytenus peduncularis* and *Scolopia mundtii* are the chief plants used for making walking-sticks. The choice of suitable woods for this article is a matter of great concern to most Bantu males, since walking-sticks also serve as fighting-sticks.

(*h*) *Garden Plants.*—*Kniphofia caulescens* with showy racemes of white and red flowers is one of the few local plants cultivated by the Bantu for decorative purposes.

(*i*) *Firewood.*—Forest, scrub and *Protea* Savanna suffer considerably from depredation by Bantu seeking firewood. The locations adjoining the Forest Reserve are now practically devoid of woody vegetation.

Almost any wood is used for fuel. On the summit where heavy wood is absent, the Basutos use the alpine heath shrubs. Some of them, for example *Helichrysum trilineatum* and *Eumorphia sericea*, burn readily even when green. This may be due to a high oil and resin content, a feature of many high mountain plants.

(*j*) *Timber for Building, etc.*—As indicated on p. 44 there is evidence that the yellowwood forests in the Cathedral Peak area were exploited by the Europeans many years ago for their useful timbers.

9.1.2. *Fire*

Apart from natural fires caused by lightning and by rock falls, the mountain area has long been subject to fires caused by man. It is probable that the Drakensberg Bushmen periodically set a light to grassland to produce new growth which would attract game for hunting: this was the practice of Bushmen elsewhere in South Africa (Burchell, 1822, p. 419). There is abundant evidence (Holden, 1855; Mann, 1859) that the Bantu and later the European farmer fired the grassland to provide winter grazing for their cattle and sheep.

To-day burning of the grassland is an annual or biennial practice. The Basutos burn the grassland on the summit and occasionally the grassland on the Natal side. The latter grassland is burnt to attract game for hunting. The local Bantu say that the Basutos throw burning sacks over the cliff edge to start the fires in Natal. The Forestry Department burns the grassland biennially in spring after the first rain of ½ in (13 mm) or more. As stated on p. 86 this system is largely responsible for the fine sward of *Themeda triandra* on the Little Berg. In addition, the Forestry Department burns firebreaks in autumn and in winter. The Bantu in the locations adjoining the Cathedral Peak Forest Influences Research Station and the European farmers burn anually, any time between May and September.

The general effect of fire is to prevent the succession from progressing beyond the grassland stage. Thus in each of the belts grassland is the predominant community and has the status of a fire subclimax or fire depending upon whether one follows the doctrines of Clements (1916) or Tansley (1935).

9.2. Mammals

It is clear from the writings of Mann (1859), Moodie (1888) and others that as late as 1880 mammals were still plentiful in the Drakensberg area. Mann (l.c., p. 163) states that the blesbok, quagga, wildebeest and zebra accompanied by lion were to be found " under the Drakensberg " during the three coldest months of the year. According to Mann these animals migrated into Natal each winter in search of pastures. Moodie (l.c., p. 149) writing about the summit of the Drakensberg states: " . . . a high-soaring condor* seems to be the only representative of animal life in this part, while the country a few miles lower down teems with every charming variety of wild animal in existence ". To-day it is possible to spend a whole day in the mountains without encountering a single mammal.

Baboons (*Papio ursinus orientalis*) occur at all altitudes. They are very partial to the taller species of *Hypoxis*. They eat only the succulent leaf-bases of the plant—similarly with *Kniphofia longiflora* and *K.* sp. (1857). The fruits of *Euphorbia clavarioides*, *Scolopia mundtii* (Red Pear) and the ovules of *Encephalartos ghellinckii* also contribute to their diet. Baboons, as pointed out by Schelpe (1946, p. 45), play an important part in the dispersal of *Encephalartos ghellinckii*.

Monkeys are apparently absent in the Cathedral Peak area, but Mr. Buchler, Forestry Department foreman at Monks Cowl, states that the Vervet Monkey (*Cercopithecus aethiops pygerythrus*) is to be found in the Cathkin Peak area.

Eland (*Taurotragus oryx oryx*) occur chiefly on the Little Berg. Mr. E. C. Thrash, former Conservator of the Giants Castle Game Reserve, estimates that they number about 2,000 head. Eland are browsers as well as grass-eaters. Plants which they browse include *Buddleia salviifolia*, *Myrsine africana*, *Phygelius capensis*, *Athanasia acerosa*, *Halleria lucida*, *Buchenroedera lotononoides* and *Helichrysum setosum*. According to Mr. Thrash eland, and cattle as well, are particularly fond of *Buddleia salviifolia*.

Apart from eland, the author has seen five other species of antelope. The vaalribbok (*Pelaea capreolus*) and rooiribbok (*Redunca fulvorufula*) are a characteristic feature of the Drakensberg landscape. Though essentially grassland animals, they often penetrate scrub where they closely

* Presumably the Cape Vulture (*Gyps coprotheres*).

crop *Anoiganthus breviflorus* and other herbs. The remaining antelopes are the duiker (*Sylvicapra grimmia burchellii*), Cape klipspringer (*Oreotragus oreotragus oreotragus*) and the Cape bushbuck (*Tragelaphus scriptus sylvaticus*).

Rodents are fairly common. The ground on the summit of the Drakensberg is riddled with burrows made by a rodent which is probably the ice-rat (*Myotomys sloggettii robertsii*). Specimens of this species examined by the author in the Transvaal Museum look very much like the animal seen in the field. It is common to find the inflorescences of *Helichrysum subglomeratum* lying outside the entrances to the burrows. *H. sublgomeratum* has a grey-lanate indumentum, consequently it is possible that the ice-rats use the plant for insulating their nests.

Frequent on the Little Berg is the vlei-rat (*Otomys irroratus irroratus*). Nänni (1956, p. 23) reports that the vlei-rat causes considerable losses in the young plantations of *Pinus patula* on the Research Area. This rodent ringbarks the young transplants causing their death. It is reasonable to assume that the animal also causes some damage to indigenous plants.

The formation of hummocks in seepage areas on the summit by the Natal mole-rat (*Cryptomys natalensis natalensis*), another rodent, or Jacot-Guillarmod's golden mole (*Chlorotalpa guillarmodii*), a true mole, has already been referred to on p. 88.

Other mammals present are the jackal (*Thos mesomelas mesomelas*), porcupine (*Hystrix africae-australis*), dassie (*Procavia capensis*) and the hare (*Lepus* spp. and *Pronolagus* spp.).

9.3. Birds

According to Mr. Thrash there are 142 bird species in the Natal Drakensberg. At Cathedral Peak the author has identified only 48 species with any certainty. The species are listed below together with notes on their local distribution, observed feeding habits and any points of botanical interest. The scientific names are taken from Roberts (1957). The abbreviations Z, S, or X after the native names refer to Zulu, Sesutho and Xosa respectively.

Name	General Remarks
Ardea melanocephala .... Black-headed Heron	Occasional on Little Berg and in Mlambonja Valley. Feeds on frogs, mice and large insects.
Bubulcus ibis .... Cattle Egret or Tick Bird i-Landa (Z)	Rare on Little Berg, but fairly frequent in Mlambonja Valley. Feeds on ticks and insects.
Scopus umbretta .... Hammerhead u-Thekwana (Z)	Occasional in vleis on Little Berg and in Mlambonja Valley. Eats frogs and tadpoles.
Ciconia ciconia ciconia .... White Stork u-Doye or u-Nogolantethe (Z)	Flocks of up to 20 birds seen on Little Berg. Subsists on insects in grassland.

Name	General Remarks
Hagedashia hagedash hagedash.......... Hadedah Ibis i-Nkankane (Z)	Small parties seen in Mlambonja Valley. Feeds on insects and snails.
Anas sparsa sparsa.................... African Black Duck i-Dada (Z)	Rare in pools and weirs on Little Berg. More frequent in the river valleys.
Sagittarius serpentarius................. Secretary Bird u-Mamlangwane or in-Tinginoni (Z)	Occasional on Little Berg, usually in pairs. Subsists on small animals, snakes and large insects.
Gyps coprotheres...................... Cape or Kolbe's Vulture i-Nge (Z)	Occasional along basalt cliffs of main escarpment. Migrates to Cave Sandstone cliffs in winter when main escarpment is covered in snow. Feeds on dead animals
Falco tinnunculus rupicola.............. Cape Rock Kestrel u-Mathebethebeni (Z)	Fairly frequent on Little Berg. Feeds on insects and lower vertebrates.
Elanus caeruleus caeruleus.............. Black-shouldered Kite u-Giyo or u-Nhloyile (Z)	Rare to occasional on Little Berg. Subsists on small mammals.
Aquila verreauxi....................... Black or Verreaux's Eagle u-Khozi (Z)	Rare to occasional on Little Berg and summit. Subsists on dassies and other mammals.
Buteo rufofuscus rufofuscus............. Jackal Buzzard in-Hlandlokazi (Z)	Fairly frequent on Little Berg. Feeds on lower vertebrates and said by Bantu to like grasshoppers. On 6 March, 1952, seen swooping upwards with 3 ft (0·9 m) molesnake which it eventually released from a great height.
Accipiter rufiventris rufiventris.......... Red-breasted Sparrowhawk u-Hele or u-Nhloyile (Z)	Rare in Drakensberg area. Subsists on insects and birds.
Francolinus levaillanti levaillanti......... Redwing Francolin in-Tendele (Z)	Rare on Little Berg and in Mlambonja Valley. Subsists on seeds and insects.
Coturnix coturnix africana.............. African Quail isi-Gwece or isi-Gwaca (Z)	Occasional on Little Berg and in Mlambonja Valley. Feeds on insects and seeds.
Numida meleagris coronata............. Crowned or Common Guineafowl im-Pangele (Z)	Flocks fairly frequent in Mlambonja Valley. Feeds on insects and seeds.
Columba guinea phaeonata.............. Cape Rock Pigeon i-Vukuthu (Z)	Occasional in Cathedral Peak area. Feeds on fruits and seeds.
Columba arquatrix arquatrix............ Rameron or Olive Pigeon i-Vukuthu (Z)	Common on Little Berg in vicinity of Cave Sandstone cliffs and on summit. Feeds on fruits and seeds.
Streptopelia capicola capicola........... Cape Turtle Dove i-Hobhe or i-Jubu (Z) le-Ebana-khoroana (S)	Rare on Little Berg, but fairly common in Mlambonja Valley. Feeds on fruits and seeds.

Name	General Remarks
Cuculus solitarius Red-chested Cuckoo Phezu-komkhono (Z) Phezu-komkhoba (X)	Fairly frequent in forest and scrub. Insectivorous.
Bubo capensis capensis Cape Eagle Owl isi-Khova (Z)	Rare at 9,000 ft (2,743 m). Feeds on small mammals and birds.
Megaceryle maxima maxima Giant Kingfisher isi-Vuba (Z)	Very rare along streams on Little Berg. More frequent in Mlambonja Valley. Feeds on fish.
Geocalaptes olivaceus Ground Woodpecker isi-Qophamuthi (Z) Mokhetle (S)	Fairly frequent along Ndedema and Mlambonja Rivers. Nests in holes burrowed in banks. Insectivorous.
Hirundo albigularis White-throated Swallow	Common in Drakensberg area during summer. Insectivorous.
Dicrurus adsimilis adsimilis Fork-tailed Drongo	Occasional in Mlambonja Valley. Insectivorous.
Corvus capensis Black Crow i-Gwabayi or i-Gwababa (Z)	Occasional to fairly frequent on Little Berg and in Mlambonja Valley. A scavenger.
Corvultur albicollis Cape Raven -Gwabayi or in-Gwababana (Z)	Occasional on Little Berg and in Mlambonja Valley. A scavenger.
Chaetops frenatus aurantius Orange-breasted Rock Jumper	Common among boulders at about 9,000 ft (2,743 m.) Subsists on insects and earthworms.
Saxicola torquata caffra Cape Stone Chat isi-Qhawane (Z)	Common along water courses on Little Berg and in Mlambonja Valley. Insectivorous.
Pyconotus barbatus layardi Black-eyed Bulbul i-Phothwe (Z)	Common along water-courses on Little Berg and in Mlambonja Valley. Feeds on fruits and insects.
Cossypha dichroa Noisy Robin u-Gaga (Z)	Rare in forest. Insectivorous.
Cisticola ayresi ayresi Ayre's Cloud Cisticola v-Cilo (Z)	Common on Little Berg. Feeds on high-flying insects.
Cisticola fulvicapilla fulvicapilla Neddicy u-Ngcede (Z)	Frequent in *Themeda triandra* Grassland on Little Berg and in Mlambonja Valley. Insectivorous.
Cisticola natalensis natalensis Croaking Cisticola u-Vuze (Z)	Rare on Little Berg. Insectivorous.
Muscicapa adusta adusta Dusky Flycatcher u-Nomaphelana, u-Ve or isi-Celegu (Z)	Occasional in forest. Insectivorous.

Name	General Remarks
Macronyx capensis capensis............ Cape Longclaw i-Qomfi (Z)	Frequent in grassland on Little Berg and in Mlambonja Valley. Insectivorous.
Telophorus zeylonus zeylonus........... Bush Shrike or Bokmakierie um-Qoqongo or i-Qola (Z)	Rare on Little Berg and in Mlambonja Valley. Insectivorous.
Onychognathus morio morio............ Red-winged Starling i-Somi (Z)	Common in Cathedral Peak area. Feeds upon fruit and small earth-worms which appear after rain.
Spreo bicolor......................... Pied Starling	Occasional to fairly frequent in Mlambonja Valley. Feeds on insects and fruit.
Nectarinia famosa.................... Malachite Sunbird i-Ncwincwi (Z)	Frequent in Cathedral Peak area. Seen visiting *Melianthus villosus*, *Protea subvestita*, *Watsonia socium*, *Syncolostemon macranthus* and garden flowers for nectar. This and the next species almost certainly play a part in pollination.
Cinnyris chalybeus subalaris............ Lesser Double-collared Sunbird i-Ncwincwi (Z)	Rare to occasional in Cathedral Peak area. Seen visiting *Phygelius capensis* and garden flowers.
Zosterops pallidus virens............... Cape White-eye u-Mehlwana (Z)	Frequent in forest and fynbos. Chiefly frugiverous. Seen eating fruit of *Rhus dentata* var. *puberula*.
Ploceus cucullatus spilonotus........... Spotted-backed Weaver Bird i-Hlokohloko (Z)	Frequent in reedswamp on banks of Mhlwazeni River. Granivorous.
Euplectes orix orix................... Red Bishop Bird isi-Gwe (Z)	Fairly frequent in reedswamp on banks of Mhlwazeni River. Granivorous.
Coliuspasser capensis approximans....... Cape Widow Bird u-Mahambonojojo (Z)	Common along water courses on Little Berg and in Mlambonja Valley. Granivorous.
Coliuspasser ardens ardens............. Red-collared Widow Bird i-Ntaka (female) and u-Jojo (male) (Z)	Common in flocks along streams and in vleis on Little Berg and in Mlambonja Valley. Granivorous. The local Bantu say this bird is a pest when *Sorghum caffrorum* (kaffir corn) is fruiting.
Diatropura progne progne............. Long-tailed Widow Bird u-Jojo (referred to as i-Sakabuli elsewhere) (Z)	Occasional. Granivorous.
Vidua macroura...................... Pin-tailed Whydah u-Jojo (Z)	Rather rare on Little Berg, but common in Mlambonja Valley, usually in vicinity of human habitations. Feeds on seeds, e.g. *Panicum laevifolium* var. and *Chenopodium foetidum* var. *multiflorum*.
Serinus canicollis canicollis............ Cape Canary um-Zwilili (Z)	Occasional on Little Berg. Granivorous.

CHAPTER 10

FLORISTIC DATA AND CHECK-LIST

10.1. FLORISTIC DATA

Analysis of the vascular flora of the Cathedral Peak area shows that there are 41 pteridophytes, five gymnosperms, 305 monocotyledons and 556 dicotyledons giving a total of 907 species belonging to 419 genera. Angiosperm families comprising 1 per cent or more of the total number of species are listed in order of numerical importance in Table 12, part 1.

The remaining families are: Celastraceae (8 species), Juncaceae, Santalaceae, Ranunculaceae, Anacardiaceae (6), Caryophylleaceae, Cruciferae, Malvaceae, Boraginaceae (5), Proteaceae, Phytolaccaceae, Flacourtiaceae, Onagraceae, Ebenaceae, Loganiaceae (4), Restionaceae, Polygonaceae, Sterculiaceae, Acanthaceae, Dipsaceae (3), Araceae, Eriocaulaceae, Velloziaceae, Dioscoraceae, Myricaceae, Moraceae, Urticaceae, Amarantaceae, Oxalidaceae, Rutaceae, Icacinaceae, Melianthaceae, Rhamnaceae, Vitaceae, Araliaceae, Myrsinaceae, Solanaceae, Gesneraceae, Lentibulariaceae, Cucurbitaceae (2), Potamogetonaceae, Aponogetonaceae, Xyridaceae Commelinaceae, Piperaceae, Salicaceae, Ulmaceae, Chenopodiaceae, Aizoaceae, Menispermaceae, Papaveraceae, Fumariaceae, Droseraceae, Pittosporaceae, Linaceae, Meliaceae, Aquifoliaceae, Sapindaceae, Balsaminaceae, Tiliaceae, Ochnaceae, Guttiferae, Achariaceae, Begoniaceae, Oliniaceae, Halorrhagidaceae, Cornaceae, Apocynaceae, Valerianaceae (1).

The largest genera are as follows: *Helichrysum* (44 species), *Senecio* (28), *Erica* (19), *Moraea*, *Crassula* (13), *Sebaea* (9), *Eragrostis*, *Polygala* (8), *Kniphofia*, *Schizoglossum*, *Zaluzianskya*, *Wahlenbergia*, *Berkheya* (7), *Danthonia*, *Bulbostylis*, *Carex*, *Satyrium*, *Eulophia*, *Rhus*, *Euryops*, *Athrixia* (6), *Lobelia*, *Digitaria*, *Festuca*, *Cyperus*, *Scirpus*, *Juncus*, *Aloe*, *Disperis*, *Thesium*, *Cliffortia*, *Clutia*, *Maytenus*, *Alepidea*, *Stachys*, *Sutera* and *Aster* (5).

There have been several attempts to classify South Africa into floral regions, for example those of Thode (1901), Marloth (1905), Bolus (1905) and Hutchinson (1946). Broadly the systems have been the same, but the Natal Drakensberg has been variously treated. Thus Thode (l.c., p. 1) regarded the Drakensberg as a subdivision of the Kaffrarian Province; Marloth (l.c., p. 589) considered it as lying along the boundary of the High Veld and Kaffrarian Centres; Bolus (l.c., p. 230) included it in his Kalahari Region but suggested that it might fall in a distinct subdivision; while Hutchinson (l.c., p. 550) included it in his Subalpine Region. However, Phillips (1917, p. 17) was the first to assign the Natal Drakensberg to what is probably its correct position. After an intensive floristic study of Basutoland and the adjoining provinces, Phillips concluded that Basutoland and the Natal Drakensberg constituted a distinct region which he called the Eastern Mountain Region. The list of predominating families given by Phillips for the region agrees closely with that for the Cathedral Peak area (see Table 12 for a comparison). This agreement points to the homogeneity of Phillips's Eastern Mountain Region.

It is well known that, in addition to a subtropical element, the South African flora contains a temperate element which extends from the south-western Cape along the Drakensberg and the mountains of tropical Africa to Europe (Bews, 1925, p. 9). The relation of the flora of the Drakensberg to that of neighbouring temperate centres is therefore of considerable

TABLE 12.—Predominating families in the Cathedral Peak Area and the Eastern Mountain Region

1. Cathedral Peak Area

Family	No. of species	Percentage of total
1. *Compositae*	154	17·88
2. *Gramineae*	100	11·61
3. *Liliaceae*	47	5·46
4. *Cyperaceae*	46	5·34
5. *Scrophulariaceae*	46	5·34
6. *Orchidaceae*	44	5·11
7. *Iridaceae*	32	3·72
8. *Leguminosae*	27	3·14
9. *Asclepiadaceae*	21	2·44
10. *Ericaceae*	20	2·32
11. *Labiatae*	20	2·32
12. *Umbelliferae*	17	1·97
13. *Rubiaceae*	16	1·86
14. *Campanulaceae*	15	1·74
15. *Amaryllidaceae*	15	1·74
16. *Crassulaceae*	14	1·63
17. *Euphorbiaceae*	12	1·39
18. *Gentianaceae*	12	1·39
19. *Thymelaeaceae*	11	1·28
20. *Rosaceae*	11	1·28
21. *Polygalaceae*	10	1·16
22. *Geraniaceae*	9	1·05

2. Eastern Mountain Region (Phillips, 1917)

Family	No. of species	Percentage of total
1. *Compositae*	286	18·05
2. *Gramineae*	146	9·21
3. *Liliaceae*	101	6·37
4. *Leguminosae*	95	5·99
5. *Orchidaceae*	89	5·61
6. *Scrophulariaceae*	86	5·42
7. *Cyperaceae*	75	4·73
8. *Asclepiadaceae*	51	3·21
9. *Amaryllidaceae*	39	2·46
10. *Iridaceae*	36	2·27
11. *Crassulaceae*	35	2·20
12. *Labiatae*	34	2·14
13. *Campanulaceae*	31	1·95
14. *Geraniaceae*	29	1·83
15. *Selaginaceae*	29	1·83
16. *Gentianaceae*	21	1·32
17. *Umbelliferae*	21	1·32
18. *Cruciferae*	20	1·26
19. *Ericaceae*	20	1·26
20. *Rubiaceae*	20	1·26
21. *Ficoideae*	18	1·13

phytogeographical interest. To study this relation the flora of the Cathedral Peak area, which may be regarded as fairly representative of the Drakensberg centre, is compared with that of the Cape centre as delimited by Bolus (l.c., p. 207) and with the Chimanimani Mountains in Southern Rhodesia, the most southerly of the tropical African mountains. The comparison (Table 13) is facilitated by the publication recently of a check-list of the Chimanimani Mountains by Goodier & Phipps (1961).

Table 13.—Number of genera and species common to the Drakensberg, and the Cape and Chimanimani Mountain Centres, and expressed (in brackets) as a percentage of the total number of genera and species in the Drakensberg

	Cape		Chimanimani Mts.	
	Genera	Species	Genera	Species
Drakensberg	323 (77·09)	242 (26·68)	232 (55·38)	133 (14·67)

The figures suggest that the Drakensberg centre has closer floral affinities with the Cape than with the Chimanimani Mountains. However, if the Drakensberg centre had been compared with the tropical African mountains as a whole the affinities might have been more nearly equal.

It is surprising how few of the many genera common to the Drakensberg and the Cape are characteristic Cape genera. By characteristic is meant genera like *Protea*, *Erica*, *Muraltia* and *Tetraria* which are developed principally in the south-western Cape. Of the 282 angiosperm genera which Weimarck (1941, pp. 90–97) regards as characteristic Cape genera only 24 occur in the Drakensberg or, in other words, only 6·3 per cent of the Drakensberg genera are characteristic Cape genera. As might be expected the figures are even lower for the more northerly situated Chimanimani Mountains: 13 genera and 3·3 per cent. It is important to realize, however, that though the Cape genera are few in number, they are very important ecologically. For example in the Drakensberg the dominant species of subalpine fynbos and alpine heath belong very largely to characteristic Cape genera.

Much of the flora common to the temperate centres belongs to the forest element. In the Cape this element is mainly confined to the Knysna area. Among the forest tree species common to the Cape and the Drakensberg are *Podocarpus latifolius*, *Ocotea bullata*, *Celtis africana*, *Pittosporum viridiflorum*, *Calodendrum capense*, *Buddleia salviifolia*, *Ilex mitis*, *Myrsine africana*, *Rapanea melanophloeos*, *Diospyros whyteana*, *Maytenus acuminatus*, *Halleria lucida*, *Apodytes dimidiata*, *Kiggelaria africana* and *Scolopia mundtii*. With the exception of the first five-named species, these species extend to the Chimanimani Mountains.

Two other elements are also involved, namely the afro-montane and afro-european elements of Weimarck (1941, p. 124). An example of the afro-montane element is *Swertia* which is centred mainly in the tropical African mountains, but extends to the Drakensberg. There are numerous

examples of the Afro-European element: genera like *Aira*, *Ranunculus*, *Anemone*, *Clematis*, *Cerastium*, *Cardamine* and *Dianthus*, occur right to the Cape.

With increase in altitude the flora of the Drakensberg becomes increasingly temperate in character. This is very strikingly illustrated in the Gramineae. In the Montane Belt practically all the grasses belong to subtropical genera, for example *Hyparrhenia*, *Andropogon*, *Themeda* and *Heteropogon*, in the Subalpine Belt the temperate genera *Festuca*, *Danthonia* and *Pentaschistis* become more prominent, and in the Alpine Belt these temperate genera are completely dominant. The percentage of grasses belonging to the temperate tribes Aveneae, Festuceae, Phalarideae, Danthonieae, Brachypodieae and Ehrharteae in each of the three vegetation belts is 5, 27 and 82 per cent respectively.

There has been considerable confusion about the identity of the Drakensberg *Protea* species. For example, Schelpe (1946) referred to *P. multibracteata* as *P. flanaganii* and West (1951) referred to it as *P. caffra*. *Protea dracomontana*, a recently described subalpine species, has been called *P. abyssinica* (Schelpe, 1946), *P. hirta* (West, 1951) and *P. rhodantha*. The taxonomy of the summer-rainfall *Protea* species has recently been cleared up by Beard (1958, pp. 41–65). The following vegetative key produced by the present author may help in distinguishing the species in the field:—

1. Plants less than 1·2 m high .... 2.
   Plants more than 1·2 m high .... 3.
2. Leaves more than 15 mm wide .... *P. dracomontana*
   Leaves less than 15 mm wide .... *P. simplex*
3. Leaves glabrous, green .... *P. multibracteata*
   Leaves villous (at least the upper), somewhat greyish .... 4.
4. Small tree, leaves 7·5–14 cm long × 2–4 cm wide .... *P. roupelliae*
   Shrub with slender branches; leaves 4–8 cm long × 1–2·5 cm wide .... *P. subvestita*

P. simplex is apparently absent from the Cathedral Peak area.

10.2. Check-List

The check-list which follows may be regarded as representative of the vascular plants of the Cathedral Peak area, but not of the algae and bryophytes. It was originally intended to produce a comprehensive check-list citing the gatherings of Marriott, Krook, Esterhuysen, Schelpe and other collectors in the Cathedral Peak area, but it was found that the naming of their specimens was often so unreliable, that it would have reduced the usefulness of the present check-list.

The families and genera have been arranged according to the following authorities:—

Bryophyta: Sim (1926).
Filicinae: Christensen (1938).
Spermatophyta: De Dalla Torre & Harms (1900–1907).

For convenience, species have been arranged alphabetically. The abbreviations of author-names are those used at Kew in the Tropical African floras. The numbers cited in the check-list are the author's collecting numbers. All specimens are housed at the National Herbarium, Pretoria.

ALGAE

Characeae

Nitella sp. Fairly frequent in pools in Montane Belt........................ 1754

BRYOPHYTA

Polytrichaceae

Pogonatum simense (B. et S.) Jaeg. Locally abundant on basalt outcrops at edge of Little Berg.. 1130

Polytrichum commune L. Frequently dominant on basalt outcrops at edge of Little Berg.. 3439

Dicraniaceae

Campylopus trichodes Lorentz. Frequently dominant on Cave Sandstone pavements.. 3441

Grimmiaceae

Ptychomitrium cucullatifolium (C.M.) Jaeg. Common on basalt outcrops at edge of Little Berg.. 3438

Tortulaceae

Hyophila zeyheri (Hampe) Jaeg. Frequently dominant on Cave Sandstone pavements.. 3440

Bartramiaceae

Philonotis afrofontana (C.M.) Par. Locally abundant on wet rock faces on Little Berg.. 1131

P. laeviuscula Dixon. Occasional in shallow pools at edge of Little Berg.... 3444

Brachytheceaceae

Pleuropus sericeus (Horns.) Broth. Abundant on damp boulders in *Podocarpus latifolius* Forest.. 984

PTERIDOPHYTA

Lycopodiaceae

Lycopodium saururus Lam. Rare on floor of *Podocarpus latifolius* Forest and locally common in seepage areas on summit........................ 1896, 3435

Lycopodium verticillatum L.f. Rare to occasional on moist rock faces in *Podocarpus latifolius* Forest... 1679

Selagninella imbricata (Forsk.) Spring ex Decne. Occasional on basalt pavements at edge of Little Berg.. 3442

Equisetaceae

Equisetum ramosissimum Desf. Common on flats adjacent rivers in Montane Belt.. 1717

Ophioglossaceae

Ophioglossum reticulatum L. Locally common in shallow, moist depressions on Little Berg... 1267

Ophioglossum sarcophyllum Desv. Locally common in *Themeda triandra* Grassland and in moist depressions on Little Berg....................... 1053, 1603

Osmundaceae

Osmunda regalis L. Very locally common in moist part of grassland in Umhlonhlo Valley... 3449

Schizaeaceae

Mohria caffrorum (L.) Desv. Frequent on streambanks and outcrops. A ubiquitous species occurring in moist and dry situations in both the Montane and Subalpine Belts.. 1081

GLEICHENIACEAE

Sticherus umbraculiferus (Kunze) Ching. Fairly frequent along margin of *Podocarpus latifolius* Forest and on streambanks on Little Berg......... 987

HYMENOPHYLLACEAE

Trichomanes melanotrichum Schlecht. Frequent as epiphyte or lithophyte in *Podocarpus latifolius* Forest.................................... —

Cyathea dregei Kunze. Fairly frequent on streambanks in Montane Belt and up to 6,700 ft (2,312 m) in Subalpine Belt............................ 1357

POLYPODIACEAE

Pteridioideae

Pteridium aquilinum (L.) Kuhn. Dominant in Bracken Veld in the Montane Belt and up to c. 6,700 ft (2,312 m) in the Subalpine Belt............. —

Pteris cretica L. Fairly frequent in *Leucosidea sericea* Scrub on Little Berg 1072

Pteris quadriaurita Retz. Forms frequent societies in field layer of *Podocarpus latifolius* Forest.. 1969

Gymnogrammeoideae

Pityogramma austroamericana Domin. Occasional in crevices on Cave Sandstone cliffs.. 1923

Adiantum poiretii Wilkstr. Forms societies in *Podocarpus latifolius* Forest and occasional under waterfalls on Little Berg........................... —

Cheilanthes hirta Sw. var. *laxa* Kunze. Occasional in *Podocarpus latifolius* Forest... 1393

Notholaena eckloniana Kunze. Occasional among boulders in grassland and on rock outcrops on Little Berg....................................... —

Pellaea calomelanos (Sw.) Link. Occasional among boulders in Montane Belt —

P. quadripinnata (Forsk.) Prantl. Common on outcrops and cliff ledges and in *Cymbopogon validus* Grassland on Little Berg........................ —

Blechnoideae

Blechnum attenuatum (Sw.) Mett. Forms frequent societies in *Podocarpus latifolius* Forest, usually near streams.............................. 2363

B. australe L. Locally common in crevices on Cave Sandstone cliffs....... 2128

B. punctulatum Sw. Occasional in crevices on Cave Sandstone cliffs......... 1929

Asplenioideae

Asplenium monanthes L. Occasional—fairly frequent in *Podocarpus latifolius* Forest.. 982, 983

A. rutaefolium (Berg.) Kunze. A common epiphyte in *Podocarpus latifolius* Forest.. 1068

A. splendens Kunze. Occasional in *Podocarpus latifolius* Forest............. —

A. trichomanes L. Rare in rock crevices in Alpine Belt.................... 1981

Athyrium schimperi Moug. Locally common on moist soil under Cave Sandstone overhangs.. 1944

Cystopteris fragilis (L.) Bernh. Rare on floor of *Podocarpus latifolius* Forest 1678

Woodsioideae

Woodsia burgessiana Gerr. Locally abundant in boulder crevices on summit of Drakensberg... 1962

Dryopteridoideae

Dryopteris athamantica (Kunze) O. Kuntze. Locally abundant in moist gullies on Little Berg.. 1356

D. pentheri (Krass.) C. Chr. Fairly frequent in *Podocarpus latifolius* Forest and in shade of large boulders on summit of Drakensberg........... 1133, 1961

D. thelypteris (L.) Gray var. *squamigera* Schlecht. Locally dominant in vleis on Little Berg.. 1530

Polystichum luctuosum Moore. Rare—occasional in *Podocarpus latifolius* Forest........ 1155

P. sp. cf. *P. setiferum* (Forsk.) Woynar. Frequently locally dominant in field layer of *Podocarpus latifolius* Forest and in fynbos........ 981, 1134

Polypodioideae

Pleopeltis lanceolata (L.) Kaulf. Epiphyte. Occasional in *Podocarpus latifolius* Forest and in *Leucosidea sericea* Scrub on Little Berg........ 1146, 1955

Polypodium ecklonii Kunze. Epiphyte. Fairly frequent in *Podocarpus latifolius* Forest........ 1694

P. schraderi Mett. Epiphyte. Frequent in *Leucosidea sericea* Scrub on Little Berg........ 1067

P. vulgare L. Frequent in rock crevices on summit of Drakensberg........ 1980

Elaphoglossoideae

Elaphoglossum angustatum (Schrad.) Hieron. Common on moist rock faces in *Podocarpus latifolius* Forest........ 1673

E. spathulatum (Bory) Moore. Locally abundant on moist cliff faces in Subalpine Belt........ 1054

GYMNOSPERMAE

Cycadaceae

Encephalartos ghellinckii Lem. Occasional in vicinity of Cave Sandstone and basalt cliffs at edge of Little Berg, among boulders in grassland and fairly frequent in fynbos........ —

Taxaceae

Podocarpus falcatus R. Br. Rare in Indumeni Forest........ 2142

P. henkelii Stapf. Very locally common in Indumeni Forest........ 2144

P. latifolius R. Br. Dominant tree in forests in the Drakensberg........ 1024

Pinaceae

Widdringtonia dracomontana Stapf. Forms consocies immediately above Cave Sandstone cliffs and often locally dominant in fynbos........ —

ANGIOSPERMAE

Monocotyledoneae

Potamogetonaceae

Potamogeton pusillus L. Dominant in small pools in Ndedema Valley........ 1608

Aponogetonaceae

Aponogeton spathaceum var. *junceum* Hook. f. Frequent in pools on summit of Drakensberg........ 2170

Gramineae

Imperata cylindrica (L.) Beauv. Common in moist gullies in Mhlwazeni Valley 1822

Miscanthidium capense Stapf var. *villosum* (Stapf) Phill. Frequently dominant on streambanks and along margins of scrub and forest. Moist areas generally up to 6,600 ft (2,012 m)........ 1330, 1523

Eulalia villosa (Thunb.) Nees. Occasional—fairly frequent in *Themeda triandra* Grassland up to 7,000 ft (2,133 m)........ 1139

Ischaemum arcuatum (Nees) Stapf. Frequent on islands in Mhlwazeni River.. 1712

I. franksiae J. M. Wood. Common in *Themeda triandra* Grassland in Montane Belt, but rare on Little Berg........ 1613, 1070

Trachypogon spicatus (L.f.) Kuntze. Occasional to subdominant in *Themeda triandra* Grassland........ 1288

Elyonurus argenteus Nees. Frequent in *Themeda triandra* Grassland......... 948

Andropogon appendiculatus Nees. Occasional in *Themeda triandra* Grassland, common near streams and in moist terracettes......................... 1153

A. euconus Nees. Common in moist areas in Montane Belt, but rare in Subalpine Belt.. 1435, 1448

A. filifolius (Nees) Steud. Frequent on rock outcrops in *Themeda triandra* Grassland.. 949

A. ravus J. G. Anderson. Occasional in *Themeda triandra* Grassland on Little Berg.. 1261

Cymbopogon validus Stapf ex Burtt Davy. Common—dominant on streambanks and cliff ledges, in moist gullies and along margin of fynbos, scrub and forest. Occurs up to 9,000 ft (2,743 m)............................ 1126

Hyparrhenia aucta (Stapf) Stent. Occasional in *Hyparrhenia* Grassland in Montane Belt, but more frequent on Little Berg where it is sometimes dominant on streambanks.. 1332, 1522

H. dregeana (Nees) Stapf. A dominant of *Hyparrhenia* Grassland in the Montane Belt. Often in disturbed areas.................................. 1752, 2358

H. glauca Stent. A dominant of *Hyparrhenia* Grassland in the Montane Belt 2359

H. hirta (L.) Stapf. A dominant of *Hyparrhenia* Grassland in the Montane Belt.. 1290, 1416, 2357

H. tamba Anderss. A dominant of *Hyparrhenia* Grassland in the Montane Belt.. 2360

Monocymbium ceresiiforme (Nees) Stapf. Occasional in *Themeda triandra* Grassland. Often dominant in terracettes on Little Berg................. 1504

Heteropogon contortus (L.) Beauv. Occasional—frequent in *Themeda triandra* Grassland.. 1181

Themeda triandra Forsk. Dominant grass over most of Drakensberg area up to 9,400 ft (2,865 m)... 1622

Arundinella nepalensis Trin. Locally dominant along margin of vleis on Little Berg.. 1499, 1665

Melinis sp. aff. *M. minutiflora* Beauv. Very locally abundant in the Mhlwazeni Valley.. 1715

Paspalum dilatatum Poir. Locally common in moist parts of grassland in Mlambonja Valley... 1785

Panicum aequinerve Nees. Occasional in field layer of *Podocarpus latifolius* Forest and locally dominant on streambanks............................ 1669

P. ecklonii Nees. Occasional in *Themeda triandra* Grassland................. 947

P. laevifolium Hack. Locally common on roadsides on Little Berg............ 1690

P. laevifolium Hack. var. Frequent in neglected garden on Little Berg......... 2305

P. natalense Hochst. Common on rock outcrops in *Themeda triandra* Grassland 1158

Alloteropsis semialata (R. Br.) Hitch. Frequent in *Themeda triandra* Grassland 1017

Brachiaria marlothii (Hack.) Stent. Frequent in neglected garden on Little Berg 2302

B. serrata (Spreng.) Stapf. Occasional on outcrops at edge of Little Berg...... 1163

Digitaria diagonalis (Nees) Stapf. Occasional in grassland in Montane Belt..... 1664

D. flaccida Stapf. Common under *Protea multibracteata* on Little Berg........ 950

D. monodactyla (Nees) Stapf. Common on outcrops in *Themeda triandra* Grassland.. —

D. setifolia Stapf. Occasional in *Themeda triandra* Grassland in Montane Belt 1782

D. ternata (Hochst.) Stapf. Occasional on rock outcrops on Little Berg.... 1373, 1518

D. tricholaenoides Stapf. Locally common on rock outcrops on Little Berg.. 1262

Rhynchelytrum setifolium (Stapf) Chiov. Common on rock outcrops at edge of Little Berg.. 1045

Oplismenus hirtellus (L.) Beauv. Forms extensive societies in *Podocarpus latifolius* Forest.. 1670

Setaria obscura de Wit. Occasional on streambanks on Little Berg.......... 1614

S. pallide-fusca (Schum.) Stapf et C. E. Hubb. Locally common on contour-path at 6,550 ft (1,996 m) on Little Berg.............................. 2303, 2324

Pennisetum natalense Stapf. Common on islands in rivers in Montane Belt. 1713, 1972

P. sphacelatum (Nees) Dur. et Schinz. Very locally common in *Themeda triandra* Grassland on Little Berg.. 1322

P. thunbergii Kunth. Frequent in vleis and on streambanks in Montane and Subalpine Belts.. 1033

Beckeropsis uniseta (Nees) Stapf ex Robyns. Frequent between cultivated fields in Mhlwazeni Valley.. 1711

Ehrharta erecta Lam. var. *natalensis* Stapf. Locally common in *Podocarpus latifolius* Forest.. 1156

E. longigluma C. E. Hubb. Abundant among boulders in Temperate Grasslands at 9,300 ft (2,835 m).. 1478

Anthoxanthum ecklonii (Nees) Stapf. Occasional in moist situations in Subalpine and Alpine Belts.................................... 1044, 1132, 1296, 2275

Aristida galpinii Stapf. Common on rock outcrops and the exposed boulder beds of rivers in the Montane and Subalpine Belts............ 954, 1235, 1246, 1247

A. monticola Henrard. Frequently dominant on streambanks on the Little Berg, co-dominant in Temperate Grasslands and abundant on the boulder bed of rivers..............................1000, 1056, 1258, 1382, 1915, 1951

Stipa dregeana Steud. Frequent in field layer of *Podocarpus latifolius* Forest 1675

Pseudobromus africanus (Hack.) Stapf. Locally frequent in field layer of *Podocarpus latifolius* Forest.. 1967

Sporobolus centrifugus Nees var. *filifolius* (Stent) Goossens. Frequent in *Pentaschistis tysonii* Grassland.................................... —

S. centrifugus Nees var. *laxivaginatus* (Stent) Goossens. Occasional—fairly frequent in *Rendlia altera* Grassland on ridges of spurs on Little Berg.. 999, 1529

S. pyramidalis Beauv. Frequent in disturbed areas in Montane Belt........... 2342

Agrostis barbuligera Stapf. Occasional—fairly frequent on moist grass slopes on Little Berg.. 1140

A. huttoniae (Hack.) C. E. Hubb. Common in vleis and on streambanks on Little Berg and summit of Drakensberg.............................. 996

Aira caryophyllea L. Very locally common at base of basalt cliffs at 9,000 ft (2,743 m).. 1476, 3433

Helictotrichum turgidulum (Stapf) Schweickerdt. Fairly frequent in moist areas on Little Berg.................................... 997, 1106, 1269, 1342

H. sp. cf. *H. hirtulum* (Steud.) Schweickerdt. Occasional in grasslands at 8,000 ft (2,438 m).. 1472

Tristachya hispida (L.f.) K. Schum. Abundant in *Themeda triandra* Grassland 1546

Loudetia simplex (Nees) C. E. Hubb. Common on outcrops in *Themeda triandra* Grassland.. 1232

Danthonia disticha Nees. One of dominants in *Danthonia–Festuca–Pentaschistis* Grassland on summit of Drakensberg.............................. 1481, 1491

D. drakensbergensis Schweickerdt. Common on streambanks on summit of Drakensberg.................................... 1831, 1836, 1843, 1884, 2183

D. macowanii Stapf var. Frequently dominant along streambanks in Montane and Subalpine Belts.. 1090

D. stereophylla J. G. Anderson. Occasional—abundant on rock outcrops above 6,400 ft (1,951 m).................................... 1184, 1317, 2339, 2349

D. stricta (Nees) Schrad. Frequent among boulders on koppies on Little Berg and in *Pentaschistis tysonii* Grassland..........................1100, 1576, 1794

D. sp. Locally abundant in grassland on ridge of Organ Pipes spur at 8,700 ft (2,652 m).. 1727

Pentaschistis oreodoxa Schweickerdt. Locally common on cliff ledges above 7,400 ft (2,256 m) and one of dominants in grassland on summit 1300, 2271, 2350

P. pilosogluma McLean. Fairly frequent on boulder beds of rivers and occasional in Temperate Grassland.. 1828, 2340

P. tysonii Stapf. One of dominants in Temperate Grasslands. 1589, 1792, 1934, 2280

Crinipes gynoglossa Goossens. A tunic grass frequently dominant on rock outcrops between 5,700 ft (1,737 m) and 9,000 ft (2,743 m) 1013, 1237, 1248, 1548, 1563, 1789

Microchloa caffra Nees. Frequent to common on rock outcrops in Montane and Subalpine Belts.. 965

Rendlia altera (Rendle) Chiov. Occasional in *Themeda triandra* Grassland and often dominant on ridges of spurs on Little Berg..................... 1544

Catalepis gracilis Stapf et Stent. Common on outcrops and in disturbed areas in Tsanatalana Valley. 8,000 ft (2,438 m)........................... 1975

Cynodon hirsutus Stent var. *parviglumis* Stent. Common in disturbed areas in Montane and Subalpine Belts... 1319

Harpechloa falx (L.f.) Kuntze. Frequent in *Themeda triandra* Grassland and common in grassland on summit.................................... 958

Chloris virgata Sw. Occasional in disturbed areas in Montane and Subalpine Belts.. 1921

Eragrostis aspera (Jacq.) Nees. Occasional in maize field in Mhlwazeni Valley 1714

E. caesia Stapf. Common on rock outcrops on Little Berg and fairly frequent in alpine grassland on summit.............................. 1228, 1313, 1321

E. capensis (Thunb.) Trin. Occasional in *Themeda triandra* Grassland....... 1377

E. curvula (Schrad.) Nees. Frequent in disturbed areas and on streambanks on Little Berg.................................... 977, 1526, 1575, 2306

E. curvula (Schrad.) Nees var. Locally common in disturbed areas on Little Berg.. 1095, 1525

E. plana Nees. Frequent in disturbed areas in Montane and Subalpine Belts 1524

E. planiculmis Nees. Fairly frequent in moist depressions on Little Berg.... 1268

E. racemosa (Thunb.) Steud. Occasional in *Themeda triandra* Grassland and common on rock outcrops... 1018

E. sp. Very rare on Cave Sandstone cliffs................................ 2127

Phragmites communis Trin. Dominant in reedswamp...................... —

Eleusine africana Kennedy-O'Byrne. Frequent in neglected garden on Little Berg.. 2304

Koeleria cristata Pers. Frequent in all short grassland types in the Drakensberg including the summit.................................... 946, 1301, 1849

Melica racemosa Thunb. Locally dominant in moist gully on Little Berg. 6,600 ft (2,012 m)... 2290

Stiburus alopecuroides Stapf. Frequently dominant in vleis in Montane and Subalpine Belts.. 944, 1413

S. conrathii Hack. Locally common in vleis on Little Berg.................. 1093

Poa binata Nees. Frequent on streambanks and in moist gullies on Little Berg and in grassland on summit.. 943

Festuca caprina Nees. Occasional in drier parts of vleis on Little Berg and one of dominants in *Danthonia–Festuca–Pentaschistis* Grassland 1077, 1089, 1315, 2281 2341,

F. caprina Nees var. *macra* Stapf. Occasional—locally frequent on streambanks above 7,000 ft (2,133 m).. 1347

F. costata Nees. Occasional on streambanks on Little Berg and a dominant of Temperate Grassland. 6,000–9,000 ft (1,829–2,743 m)...... 970, 1014, 1542

F. scabra Vahl. Frequent in *Themeda triandra*—Temperate Grassland at 9,000 ft (2,743 m).. 1833

F. sp. nov. Frequent in *Themeda triandra*—Temperate Grassland at 9,000 ft (2,743 m).. 1835, 2282, 2347

F.? sp. u-Vinde (Zulu name). Not seen in flower. Locally common in gullies just below Cave Sandstone cliffs.................................. —

Bromus speciosus Nees. Occasional on streambanks on Little Berg and a dominant of Temperate Grassland. 6,000–9,000 ft (1,829–2,743 m) 1015, 1101, 1141, 1629

Brachypodium bolusii Stapf. Rare on moist cliff ledges on Little Berg....... 1343

B. flexum Nees. Forms societies usually near streams in *Podocarpus latifolius* Forest........ 1656, 1666

Arundinaria tesselata (Nees) Munro. Locally common on streambanks in the Montane Belt........ 1893

CYPERACEAE

Ascolepis capensis Ridley. Frequent in vleis on the Little Berg............. 1031

Cyperus compactus Lam. Very locally common in *Themeda triandra* Grassland in the Mhlwazeni Valley........ 1806

C. compactus Lam. var. *flavissimus* C. B. Cl. Common on rock outcrops in grassland on the Little Berg........ 961

C. marginatus Thunb. Frequently dominant around the edge of islands in the Mhlwazeni River........ 1809

C. semitrifidus Schrad. Common on rock outcrops in grassland on the Little Berg........ 1166

C. unioloides R. Br. Frequent in vleis on the Little Berg.................. 1627

Pycreus oakfortensis C. B. Cl. Abundant—dominant in vleis and on streambanks in the Montane and Subalpine Belts........ 1030

P. rehmannianus C. B. Cl. Forms small colonies in wet places on rock outcrops at edge of Little Berg........ 1517

P. sp. aff. *P. flavescens* Reichb. Abundant in moss mats on exposed beds of streams on Little Berg........ 1369

Mariscus congestus C. B. Cl. Fairly frequent on streambanks in Montane and Subalpine Belts........ 1270, 1363

M. elatior C. B. Cl. Occasional on streambanks on Little Berg............ 1117

Kyllinga aurata Nees. Common—locally dominant on streambanks and in vleis on Little Berg........ 1103, 1273

Ficinia cinnamomea C. B. Cl. Fairly frequent in *Themeda triandra* Grassland on Little Berg........ 941

F. stolonifera Boeck. Occasional in disturbed areas on Little Berg.......... 1062

F. sp. Occasional—fairly frequent in grassland above 6,800 ft (2,073 m) on Little Berg........ 1383

Fuirena pubescens Kunth. Locally common in vleis in Montane and Subalpine Belts........ 957

Scirpus falsus C. B. Cl. Frequently dominant on moist cliff faces on Little Berg and summit, and occasional in *Festuca costata* Grassland.......... 1144, 1188

S. ficinioides Kunth. Locally common in vleis on Little Berg and moist areas generally on summit........ 1096, 1169, 2185

S. fluitans L. Forms mats in seepage areas on summit.................. 1701

S. hystrix Thunb. Common in small pools on rock outcrops at edge of Little Berg........ 1887

S. macer Boeck. Locally dominant in vleis in Montane and Subalpine Belts 959, 1112

Eleocharis palustris R. Br. Locally abundant in vleis and in shallow water of streams in Montane and Subalpine Belts.................... 1080, 1104, 1271

Fimbristylis dichotoma (L.) Vahl. Frequently dominant in vleis in Montane Belt........ 2323, 2343

F. hispidula (Vahl) Kunth. Frequent in almost bare area at Forestry Department meteorological station on Little Berg........ 1514

Bulbostylis breviculmis Kunth. Abundant on basalt outcrops on summit of Drakensberg........ 1938

B. densa (Wall.) Handel-Mazetti. Locally abundant in vleis and on small islands in streams in Montane and Subalpine Belts..................... 1366, 1437, 2344

B. humilis Kunth. Common on rock outcrops on Little Berg............... 1365

B. schoenoides Kunth. Frequent on streambanks and in vleis on Little Berg 1032

B. scleropus C. B. Cl. Frequent in stony parts of grassland immediately above Cave Sandstone cliffs........ 1788

B. trichobasis C. B. Cl. Fairly frequent in *Themeda triandra* Grassland..... 942

Rhynchospora brownii Roem. et Schult. Frequent in vleis and on streambanks in Montane and Subalpine Belts........ 1085, 1236

Tetraria cuspidata C. B. Cl. Occasional to fairly frequent in grassland above 7,000 ft (2,133 m) on Little Berg........ 1029, 1298

T. sp. nov. Frequent on moist floor of cave in Ndedema Valley........ 1598

Scleria bulbifera Hochst. ex A. Rich. Locally frequent on koppie on Little Berg........ 1063, 1579

S. dregeana Kunth. Locally abundant in mud on rock beds of streams on Little Berg........ 1084

S. woodii C. B. Cl. Occasional to fairly frequent in moist parts of *Themeda triandra* Grassland on Little Berg........ 1222, 1254

S. welwitschii Ridley. Locally dominant in vleis on Little Berg........ 1233

Schoenoxiphium filiforme Kükenth. Fairly frequent in Bracken Veld and *Pentaschistis tysonii* Grassland and locally dominant in sedge meadows on summit 1540, 1797, 2284

S. sparteum (Wahl.) C. B. Cl. Forms occasional societies in field layer of *Podocarpus latifolius* Forest........ 1279

S. sp. nr. *S. rufum* Nees var. *dregeanum* (Kunth) Kuk. Occasional in *Festuca costata* Grassland on Little Berg........ 1545

S. sp. Locally frequent in alpine grassland........ 2273

Carex cernua Boott. Common in vleis and on streambanks on Little Berg.. 991

C. glomerabilis Krecz. Fairly frequent on flats next to Sani River. Basutoland 2354

C. killickii Nelmes. Co-dominant with *C. monotropa* in sedge meadow on summit........ 1848, 2272

C. monotropa Nelmes. Co-dominant with *C. killickii* in sedge meadow on summit of Drakensberg........ 1847

C. spicato-paniculata C. B. Cl. Occasional—fairly frequent in *Podocarpus latifolius* Forest........ 985

C. zuluensis C. B. Cl. Locally common in moist places in Montane and Subalpine Belts........ 952, 1036, 1798

Araceae

Zantedeschia albomaculata (Hook. f.) Baill. Locally common on streambanks in Montane Belt........1201, 2091, 2120, 2178

Z. oculata (Lindl.) Engl. Occasional—locally common on streambanks in Montane Belt........ 2133, 2134

Restionaceae

Restio fruticosus Thunb. Fairly frequent on pavements above Cave Sandstone cliff........ 1927

R. sieberi Kunth var. *schoenoides* Pillans. Frequent on pavements above Cave Sandstone cliffs........ 1869, 1945, 2126

R. sp. Common on pavements above Cave Sandstone cliffs........ 2125

Xyridaceae

Xyris capensis Thunb. Frequent in vleis on Little Berg........ 1129

Eriocaulaceae

Eriocaulon abyssinicum Hochst. Common in muddy pools on rock outcrops at edge of Little Berg........ 1888

E. dregei Hochst. var. Very locally abundant in vlei on Little Berg and in seepage areas on summit........ 1164, 2346

Commelinaceae

Commelina africana L. Occasional in vlei on Little Berg........ 1172

Juncaceae

Juncus dregeanus Kunth var. *genuina* Buchen. Common in vleis on Little Berg.......... 1128

J. exertus Buchen. Fairly frequent in vleis and on streambanks on Little Berg. Dwarf form rare on summit.......... 1087, 2336, 2348

J. oxycarpus E. Mey. Common at edge of Mushroom Tarn on Little Berg.. 3447

J. punctorius L.f. Locally abundant in small pool of Mhlwazeni River...... 1434

J. rostratus Buchen. Locally common in vleis on Little Berg.......... 1136

Luzula africana Drege. Locally common in Temperate Grassland and *Danthonia–Festuca–Pentaschistis* Grassland.......... 1174, 2138, 2276

Liliaceae

Gloriosa or *Littonia* sp. (material sterile). Very rare in Ndedema Gorge Forest 2294

Wurmbea kraussii Bak. Locally common on stony ridge of spur on Little Berg 1186

Anthericum longistylum Bak. Occasional in *Themeda triandra* Grassland on Little Berg.......... 1043

Chlorophytum sp. Very locally frequent in *Podocarpus latifolius* Forest..... 1677

Eriospermum cooperi Bak. Locally frequent in *Themeda triandra* Grassland 1568, 1774

E. sp. cf. *E. microphyllum* Bak. Rare in *Themeda triandra* Grassland on Little Berg.......... 1020

E. sp. Locally frequent along margin of riverbank scrub at 6,200 ft (1,890 m) 1799

Kniphofia caulescens Bak. Frequent on streambanks on summit.......... 1871

K. evansii Bak. Locally frequent on streambank at 6,000 ft (1,829 m) in Catchment 2 and very rare in *Pentaschistis tysonii* Grassland at 7,500 ft (2,286 m) 1640, 1642, 1653

K. longiflora Bak. Frequent in moist areas in Montane and Subalpine Belts 1333, 1407, 1465

K. northiae Bak. Occasional on and just below summit of Drakensberg..... 1872

K. porphyrantha Bak. Locally frequent in *Themeda triandra* Grassland at 6,800 ft (2,073 m).......... 1265, 1305, 2212

K. rufa Bak. Locally frequent on streambanks on Little Berg and occasional on moist Cave Sandstone cliffs.......... 1431, 1442, 1467

K. rufa Bak. var. (yellow flowers). Locally frequent in *Themeda triandra* Grassland and *Pentaschistis tysonii* Grassland.......... 1405, 1466

K. sp. nov. Locally frequent in Temperate Grassland at c. 9,000 ft (2,743 m) and at base of small cliffs on summit.......... 1857, 2217

Notosceptrum brachystachyum A. Zahlbr. Locally frequent in *Festuca costata* Grassland on Little Berg in Champagne Castle area.......... 1867

Aloe arborescens Mill. Occasional—fairly frequent on cliffs at edge of Little Berg and very locally common in open parts of *Podocarpus latifolius* Forest —

A. aristata Haw. Forms small societies in *Leucosidea sericea* Scrub and *Podocarpus latifolius* Forest, usually near streams.......... 1631

A. boylei Bak. Locally frequent in *Themeda triandra* Grassland on Little Berg 1229

A. pratensis Bak. Locally frequent on basalt cliffs at edge of Little Berg.. 1773

A. saponaria (Ait.) Haw. Rare in grassland between Cave Sandstone and lowermost basalt cliffs.......... —

Agapanthus campanulatus Leighton. Common in stream gullies on the Little Berg.......... 1249, 2121, 2215

Tulbaghia acutiloba Harv. Locally frequent on rock outcrops at edge of Little Berg.......... 1041

T. alliaceae L. Occasional in moist areas on Little Berg.......... 1025

T. sp. nr. *T. natalensis* Bak. Occasional in grassland on Little Berg........ 1552

Albuca baurii Bak. Locally frequent in *Cymbopogon validus* Grassland in moist gully on Little Berg.......... 1801

A. trichophylla Bak. Occasional on basalt outcrops at edge of Little Berg 1402, 1660

Urginea macrocentra Bak. Forms socies in moist grassland areas between 6,900–9,000 ft (2,103–2,743 m)................................ 1623, 2140, 2206

U. sp. nr. *U. tenella* Bak. Locally abundant on rock outcrops at edge of Little Berg.. 1069

Galtonia viridiflora Verdoorn. Fairly frequent in crevices and on cliff ledges between 5,800–10,000 ft (1,768–3,048 m).................................. 1314

Drimia neriniformis Bak. Occasional in *Themeda triandra* Grassland on Little Berg.. 1193

Dipcadi marlothii Engl. Occasional in stony parts of *Themeda triandra* Grassland on Little Berg.. 1046, 1549

D. sp. Very rare in grassland on ridges of spurs on Little Berg............ 1207

Scilla bella Mark. Fairly frequent in *Themeda triandra* Grassland on Little Berg.. 1114, 1570

S. natalensis Planch. Frequent on cliffs, waterfalls and steep streambanks in Montane and Subalpine Belts... 963

S. saturata Bak. Occasional in *Themeda triandra* Grassland at 6,050 ft (1,844 m) 1009

S. sp. Very rare in *Themeda triandra* Grassland on Little Berg............ 1607

Schizocarphus rigidifolius F. van der Merwe. Fairly frequent in *Themeda triandra* Grassland in Montane and Subalpine Belts.................... 1019

S. sp. Frequent on rock outcrops on Little Berg......................... 1567

Eucomis bicolor Bak. Occasional on large boulders in *Podocarpus latifolius* Forest and on streambanks on Little Berg......................... 1370, 1654

E. humilis Bak. Forms socies in grassland at foot of cliffs between 7,300–8,500 ft (2,225–2,591 m).. 1192, 1213

E. undulata Ait. Occasional in *Themeda triandra* Grassland on Little Berg 1250, 1264, 1294

Ornithogalum pretoriense Bak. Locally frequent in moist depressions in Grassland on Little Berg.. 1560

Elsiea flanaganii (Bak.) Leighton. Locally common on streambanks on Little Berg and in *Danthonia–Festuca–Pentaschistis* Grassland.............. 1008, 2181

E. tysonii Leighton. Locally frequent in *Danthonia–Festuca–Pentaschistis* Grassland... 1855

Asparagus asparagoides (L.) Wight. Occasional—fairly frequent along margin of *Podocarpus latifolius* Forest and *Leucosidea sericea* Scrub............ 1723

A. scandens Thunb. Frequent in *Leucosidea sericea* Scrub and in fynbos on Little Berg.. 1105

A. stellatus Bak. Occasional—frequent in fynbos......................... 1861

Amaryllidaceae

Haemanthus hirsutus Bak. Occasional on boulder crevices along edge of Little Berg.. 1161

Brunsvigia natalensis Bak. Occasional in lowermost basalt cliffs at edge of Little Berg.. 1218

Anoiganthus breviflorus Bak. Occasional—fairly frequent in vleis and on streambanks in Montane and Subalpine Belts.................................. 945

A. luteus Bak. Fairly frequent in grassland on Little Berg in winter........ —

Cyrtanthus erubescens Killick. Locally common in Temperate Grassland and fynbos.. 1840, 2187

C. flanaganii Bak. Fairly frequent in grassland below small cliffs on summit 2172, 2192

C. stenanthus Bak. Very rare in Temperate Grassland...................... 2202

Hypoxis acuminata Bak. Forms large socies in *Themeda triandra* Grassland 1113, 1574

H. membranacea Bak. Frequent in Bracken Veld on Little Berg............ 1539

H. multiceps Buch. Forms large socies in *Themeda triandra* Grassland on Little Berg.. 1573

H. sp. nr. *H. argentea* Harv. Frequent on rock outcrops on Little Berg.... 967

H. sp. Common on Little Berg.. 3443

Rhodohypoxis baurii (Bak.) Nel forma *platypetala* (Bak.) Milne-Redhead. Forms socies on stony ridges of spurs on Little Berg and outcrops generally.... 964

R. palustris Killick. Locally abundant among small stones in streams on Little Berg.. 956, 1602

R. rubella Bak. Common in sedge meadow on summit of Drakensberg..... 1846

Velloziaceae

Vellozia talbotii Balf. Locally abundant on moist boulders in *Podocarpus latifolius* Forest.. —

V. viscosa Bak. Frequently dominant on vertical or nearly vertical cliff faces between 5,700–9,000 ft (1,737–2,743 m)............................ —

Dioscoraceae

Dioscorea rupicola Kunth. Occasional on streambank shrubs in Montane Belt.. 1812

D. sylvatica Eckl. Fairly frequent on streambank shrubs on Little Berg.... 1277

Iridaceae

Moraea culmea Killick. Locally frequent in *Themeda triandra* Grassland on Little Berg and occasional in *Danthonia–Festuca–Pentaschistis* Grassland 1558, 1209

M. galpinii N. E. Br. Occasional in moist gullies on Little Berg........... 1145

M. modesta Killick. Rare—occasional in *Themeda triandra* Grassland on Little Berg.. 1028, 1551A

M. mossii N. E. Br. Locally frequent in *Rendlia altera* Grassland on Little Berg.. 1583

M. pubiflora N. E. Br. Occasional on rock pavements at edge of Little Berg 1282

M. spathulata Klatt. Forms extensive socies in moist parts of *Danthonia–Festuca–Pentaschistis* Grassland.................................. 1851, 2186

M. sp. Possibly *M. violacea* Bak. Forms socies in *Themeda triandra* Grassland on Little Berg.. 1260

M. sp. Rare in grassland on Little Berg and fairly frequent in *Danthonia–Festuca–Pentaschistis* Grassland................................. 1551B, 1854

M. sp. Locally frequent in *Festuca costata* Grassland...................... 2139

M. sp. Locally frequent in *Danthonia–Festuca–Pentaschistis* Grassland....... 2182

M. sp. Frequent in *Danthonia–Festuca–Pentaschistis* Grassland.............. 2184

M. sp. Locally frequent in Temperate Grassland near Sentinel Gate, Mont aux Sources.. 2207

M. sp. Forms small socies in mud-patches on summit..................... 2191

Dietes vegeta N. E. Br. Occasional—fairly frequent in field layer of *Podocarpus latifolius* Forest.. 2149

Aristea angolensis Bak. Fairly frequent on streambanks in Montane and Subalpine Belts.. 1160, 1800

A. cognata N. E. Br. Occasional—fairly frequent in stony parts of *Themeda triandra* Grassland on Little Berg................................. 1316, 1657

Schizostylis coccinea Backh. et Harv. Occasional on banks of rivers in Montane Belt.. 2220

Hesperantha radiata Ker. Occasional on streambanks on Little Berg........ 1566

Dierama igneum Klatt. Occasional—frequent in grassland above 7,500 ft (2,286 m).. 1470

D. robustum N. E. Br. Forms socies in *Themeda triandra* Grassland on Little Berg.. 1419

Tritonia lineata Ker. Rare in *Themeda triandra* Grassland on Little Berg.. 1541

Acidanthera sp. Locally common on moist cliff faces between 5,100–9,000 ft (1,554–2,743 m).. 1490, 1943

Gladiolus crassifolius Bak. Occasional to fairly frequent in *Themeda triandra* Grassland on Little Berg.. 1445

G. ecklonii Lehm. Very rare in *Themeda triandra* Grassland on Little Berg.. 1449

G. flanaganii Bak. Occasional on moist cliff faces at c. 9,000 ft (2,743 m).. 1859

G. longicollis Bak. Occasional—fairly frequent in *Themeda triandra* Grassland on Little Berg and in *Danthonia–Festuca–Pentaschistis* Grassland on summit 1536

G. psittacinus Hook. Rare on streambanks and in vleis in Montane and Subalpine Belts.. 1636, 1808

G. subaphyllus N. E. Br. Locally frequent in *Festuca costata* Grassland on Little Berg.. 1625

G. woodii Bak. Rare—occasional in grassland on Little Berg............ 1042, 1547

Pentamenes sp. nov. Occasional—fairly frequent on moist cliff faces at edge of Little Berg.. 1655, 2313

Curtonus paniculatus N. E. Br. Occurs in dense clumps in grassland usually just below Cave Sandstone cliffs.................................... 1639

Watsonia lepida N. E. Br. Occasional—fairly frequent in *Themeda triandra* Grassland in Montane and Subalpine Belts.................. 962, 1598, 2141

W. socium L. Bol. and Mathews. Frequent at edge of Little Berg and among boulders on koppies on Little Berg................................ 1082

ORCHIDACEAE

Stenoglottis fimbriata Lindl. Forms colonies on moist boulders in *Podocarpus latifolius* Forest.. 1394

Holothrix orthoceras Reichb. Occasional in *Podocarpus latifolius* Forest...... 1395

H. scopularia Reichb. Occasional on cliffs at 7,500 ft (2,286 m) on Little Berg 1189

H. thodei Rolfe. Locally common on cliffs at 7,500 ft (2,286 m) on Little Berg 1304

Huttonaea grandiflora Rolfe. Locally common in grassland at 9,400 ft (2,865 m).. 1479, 2316

H. pulchra Harv. Forms small societies in *Podocarpus latifolius* Forest...... 1897

H. sp. nr. *H. pulchra* Harv. Rare in *Leucosidea sericea* Scrub on Little Berg 1458

Habenaria dregeana Lindl. Rare in *Themeda triandra* Grassland in Montane Belt.. 1926

H. orangana Reichb. f. Occasional in *Themeda triandra* Grassland on Little Berg.. 1353

H. petri Schltr. Occasional in *Themeda triandra* Grassland on Little Berg.. 1683

H. tridens Lindl. Frequent on banks of Mlambonja River................. 2329

Neobolusia tysonii (H. Bol.) Schltr. Occasional in vleis on Little Berg....... 1351

N. sp. nr. *N. tysonii* (H. Bol.) Schltr. Rare in grassland on Little Berg..... 1403

N. virginea (H. Bol.) Schltr. Fairly frequent in moist areas on summit.... 2168, 2264

Satyrium fanniniae Rolfe. Very rare on streambanks on summit............. 2265

S. longicauda Lindl. Occasional—fairly frequent in *Themeda triandra* Grassland on Little Berg.. 1252, 1293

S. neglectum Schltr. Common in *Danthonia–Festuca–Pentaschistis* Grassland 2320

S. parviflorum Sw. Occasional on streambanks on Little Berg.............. 1238

Schizochilus angustifolius Rolfe. Locally common in *Rendlia altera* Grassland on Organ Pipes ridge.. 2299

S. sp. cf. *S. flexuosus* Harv. Fairly frequent in *Festuca costata* Grassland.. 1324

Brownleea macroceras Sond. Fairly frequent in grassland above 9,000 ft (2,743 m).. 2319

B. parviflora Harv. Rare on boulder-bed of Ndedema River................ 1905

Disa fragrans Schltr. Common in grassland and on cliff ledges between 7,500–10,000 ft (2,286–3,048 m).. 2268, 2298

D. macowanii Reichb. f. Fairly frequent in *Themeda triandra* Grassland on Little Berg.. 1352

D. oreophila H. Bol. Occasional on Cave Sandstone cliff ledges in Umhlonhlo Valley.. 3445

D. stachyoides Reichb. f. Occasional in *Themeda triandra* Grassland on Little Berg.. 1168

D. sp. nr. *D. cornuta* Sw. Very rare in *Themeda triandra* Grassland on Little Berg.. 1208

Monadenia basutorum Rolfe. Occasional in *Danthonia–Festuca–Pentaschistis* Grassland.. 2330

Disperis cardiophora Harv. Very rare in *Themeda triandra* Grassland on Little Berg.. 1297

D. fanniniae Harv. Occasional in *Podocarpus latifolius* Forest and *Cliffortia linearifolia* and *Leucosidea sericea* Scrub on Little Berg.............. 1428, 1455

D. stenoplectron Reichb. f. Very locally frequent in *Themeda triandra* Grassland on Little Berg.. 1686

D. thorncroftii Schltr. Locally frequent in *Podocarpus latifolius* Forest.... 1217

D. tysonii H. Bol. Occasional in *Themeda triandra* Grassland on Little Berg 1450

Pterygodium hastatum H. Bol. Rare—fairly frequent in grassland between 5,000–9,000 ft (1,524–2,743 m).................................... 1674, 2317

Corycium magnum (Reichb. f.) Rolfe. Locally common on streambanks on Little Berg.. 2311

C. nigrescens Sond. Frequent in grassland on summit.................... 2351

Liparis bowkeri Harv. Locally common in *Podocarpus latifolius* Forest, usually near streams.. 1276

Polystachya ottoniana Reichb. f. Epiphyte. Fairly frequent in *Podocarpus latifolius* Forest.. 3436

Eulophia calanthoides Schltr. Locally frequent in *Cymbopogon validus* Grassland along margin of *Leucosidea sericea* Scrub on Little Berg................ 1327

E. foliosa H. Bol. Fairly frequent in *Themeda triandra* Grassland....... 1204, 1777

E. hians Spreng. Occasional in *Themeda triandra* Grassland on Little Berg.. 1244

E. leontoglossa Reichb. f. Frequent in *Themeda triandra* Grassland in Montane Belt.. 1778

E. zeyheri Hook. f. Rare in grassland in Mhlwazeni Valley................ 1810

E. sp. nr. *E. huttonii* Rolfe. Occasional in vleis on Little Berg............ 1157

DICOTYLEDONEAE

Piperaceae

Peperomia reflexa A. Dietr. Forms colonies on moist, moss-covered boulders in *Podocarpus latifolius* Forest.................................... 1390

Salicaceae

Salix woodii Seem. Fairly frequent along streams in Montane Belt.......... 2130

Myricaceae

Myrica pilulifera Rendle var. *puberula* Rendle. One of dominants in Cave Sandstone Scrub.. 1709

M. serrata Lam. Occasional on streambanks and locally common in grassland in Montane Belt.. 1650

Ulmaceae

Celtis africana Burm. f. Occcasional—fairly frequent in *Podocarpus latifolius* Forest.. —

Moraceae

Ficus ingens Miq. Occasional—fairly frequent on Cave Sandstone cliffs.... 2309

Cannabis sativa L. Very locally common in neglected garden on Little Berg 1692

Urticaceae

Fleurya mitis Wedd. Locally common in *Podocarpus latifolius* Forest	2362
Parietaria debilis Forst. Locally common at base of cliff at 9,000 ft (2,743 m)	2315

Proteaceae

Protea dracomontana Beard. Frequent—co-dominant in fynbos on N.-facing slopes above 6,700 ft (2,042 m)	—
P. multibracteata Phill. Frequently dominant in *Protea* Savanna in Montane and Subalpine Belts	1061
P. roupelliae Meisn. Frequently dominant in *Protea* Savanna in Montane and Subalpine Belts. Particularly common in vicinity of Cave Sandstone cliffs	1212
P. subvestita N. E. Br. Locally abundant in *Widdringtonia dracomontana* Fynbos in upper Indumeni Valley and rare on streambank below Sugar Loaf at 6,700 ft (2,042 m)	1974, 2300

Santalaceae

Osyris compressa A. DC. Rare along margin of *Podocarpus latifolius* Forest	1659
Thesium angulosum A. DC. Frequent in *Protea–Buchenroedera–Rhus* Fynbos at 6,800 ft (2,073 m)	1864
T. imbricatum Thunb. Occasional—fairly frequent on ridge of Organ Pipes spur and in *Danthonia–Festuca–Pentaschistis* Grassland	1586
T. racemosum Bernh. Occasional in *Themeda triandra* Grassland on Little Berg	1012
T. scirpioides A. W. Hill. Rare on rock outcrops on Little Berg	1572
T. sp. nov.? Locally common in *Danthonia–Festuca–Pentaschistis* Grassland	1883

Polygonaceae

Rumex sagittatus Thunb. Occasional on streambank shrubs in Oqalweni Valley	2364
R. woodii N. E. Br. Occasional in *Themeda triandra* Grassland and on roadsides on Little Berg	1165, 1661
Polygonum lapathifolium L. var. *maculatum* Dyer et Trin. Occasional on roadsides on Little Berg	1689

Chenopodiaceae

Chenopodium schraderianum Schult. Occasional in disturbed areas in Montane and Subalpine Belts	—

Amarantaceae

Cyathula uncinulata (Schrad.) Schinz. Rare on boulder-bed of Mhlwazeni River	1440
Achyranthes argentea Lam. Occasional—frequent in field layer of *Podocarpus latifolius* Forest	1966

Phytolaccaceae

Psammotropha alternifolia Killick. Frequent on basalt outcrops and in mud-patches on summit	1482, 1842, 2190
P. mucronata (Thunb.) Fenzl var. *mucronata*. Rare on boulder-bed of Ndedema River	1904
P. myriantha Sond. Common on rock outcrops in Montane and Subalpine Belts	1167, 1239
Phytolacca sp. Frequent on lowermost basalt cliffs at edge of Little Berg	3437

Aizoaceae

Delosperma sp. cf. *D. obtusum* L. Bol. Locally frequent on Cave Sandstone pavements in Stable Caves area	1870a

Caryophyllaceae

Cerastium arabidis E. Mey. ex Fenzl emend. Möschl. Locally frequent on streambanks on Little Berg and occasional in grassland on summit of Drakensberg	1143

C. capense Sond. Frequent in drier parts of vleis on Little Berg............ 1092

Silene burchellii Otth. Occasional in grassland on Little Berg............ 1559, 1802

S. capensis Otth. Occasional in Tall Grassland in moist areas on Little Berg 1123

Dianthus basuticus Burtt Davy s. sp. *basuticus* var. *grandiflorus* Hooper. Rare in grassland on summit.. 2205, 2283

RANUNCULACEAE

Anemone fanninii Harv. Common in moist areas in the Montane and Subalpine Belts.. 1004

Clematis brachiata Thunb. Occasional along margin of *Podocarpus latifolius* Forest and *Leucosidea sericea* Scrub................................ 1414

Ranunculus cooperi Oliv. Frequent adjacent waterfalls and on streambanks on Little Berg, locally common on cliffs of main escarpment at c. 9,000 ft (2,743 m) and a small-leaved form common on summit in moist places 2169, 2269

R. meyeri Harv. Common in pools on summit.......................... 3436

R. multifidus Forsk. Common on streambanks and in drier parts of vleis in Montane and Subalpine Belts.. 1052

Thalictrum rhynchocarpum Dill. et Rich. Occasional—fairly frequent in field layer of *Podocarpus latifolius* Forest................................ 1892

MENISPERMACEAE

Stephania abyssinica (Dill. et Rich.) Walp. var. *tomentella* (Oliv.) Diels. Occasional on streambank shrubs in Montane and Subalpine Belts............ 1814

LAURACEAE

Ocotea bullata E. Mey. Rare in *Podocarpus latifolius* Forest............... —

PAPAVERACEAE

Papaver aculeatum Thunb. Frequent in drier parts of vleis on Little Berg.. 1091

FUMARIACEAE

Fumaria officinalis L. Occasional on boulder-bed of rivers and in grassland at c. 9,000 ft (2,743 m)... 2277

CRUCIFERAE

Heliophila rigidiuscula Sond. Occasional in *Themeda triandra* Grassland above 7,400 ft (2,256 m).. 1190, 1312

H. suavissima Burch. Occasional in grassland on summit.................. 1876

H. sp. Rare among boulders on summit of Drakensberg.................. 1875

H. sp. (= Doidge s.n.). Rare on boulder-bed of Ndedema River........... 1862

Cardamine africana L. Rare in field layer of *Podocarpus latifolius* Forest... 1693

DROSERACEAE

Drosera natalensis Diels. Frequent in vleis and moist parts of grassland in the Montane and Subalpine Belts.................................. 1230

CRASSULACEAE

Kalanchoe thyrsiflora Harv. Occasional on rock outcrops in grassland and on Cave Sandstone cliffs in Montane Belt.............................. 1741

Crassula crenulata Thunb. Occasional in grassland in Masongwaan Valley at 5,900 ft (1,798 m)... 1283

C. harveyii Britt. et Bak. f. Forms colonies on outcrops usually at edge of Little Berg and in caves near summit of Drakensberg.................. 1220

C. lineolata Dryand. Occasional on streambanks on Little Berg............ 1368

C. muscosa L. Forms colonies on rock outcrops and cliff ledges on Little Berg and summit... 1346

C. natans Thunb. Abundant in moist areas on summit.................. 1988, 2337

C. platyphylla Harv. Rare on boulder-bed of Mhlwazeni River... 1597

C. rubicunda Harv. Occasional on rock outcrops on Little Berg............ 1652

C. sarcocaulis Eckl. et Zeyh. Occasional on boulder-bed of rivers and on cliffs of Little Berg.. —

C. setulosa Harv. var. *curta* (N. E. Br.) Schonl. Common under boulders on Little Berg and summit.. 1424

C. umbraticola N. E. Br. Forms colonies on moist boulders in forest, on cliff ledges and in caves in Montane and Subalpine Belts.................. 1672

C. vaginata Eckl. et Zeyh. Occasional in grassland in Montane and Subalpine Belts.. 1446, 1946

C. sp. Fairly frequent in caves on summit.............................. 2331

C. sp. Rare on boulder-bed of Indumeni River.......................... 1682

Pittosporaceae

Pittosporum viridiflorum Sims. Occasional along margin of *Podocarpus latifolius* Forest.. 1065

Rosaceae

Rubus ludwigii Eckl. et Zeyh. Common in Tall Grassland, Bracken Veld and under Proteas in Montane and Subalpine Belts........................ 1331

R. pinnatus Willd. Occasional in *Podocarpus latifolius* Forest............... 2148

Geum capense Thunb. Locally frequent in *Leucosidea sericea* Scrub on Little Berg and *Danthonia–Festuca–Pentaschistis* Grassland.................... 1147

Alchemilla natalensis Engl. Common on streambanks on Little Berg........ 1122

Agrimonia eupatoria L. var. *capensis* Harv. Occasional in *Podocarpus latifolius* Forest and in *Miscanthidium capense* Grassland on Little Berg........... 1372

Leucosidea sericea Eckl. et Zeyh. Commonly dominant in scrub on streambanks, boulder-beds and sheltered areas generally in Montane Belt where it is a forest precursor and in Subalpine Belt 4,200–6,700 ft (1,280–2,042 m).... 953

Cliffortia browniana Burtt Davy. Fairly frequent in heath near Sentinel, Mont aux Sources.. 2195

C. filicaulides H. Weim. Fairly frequent in Boulder-bed Scrub.............. 1791

C. linearifolia Eckl. et Zeyh. Frequently dominant on streambanks in Montane and Subalpine Belts. Co-dominant in Cave Sandstone Scrub......... 955, 2288

C. repens Schltr. Occasional among boulders on koppies on Little Berg.... 1109

C. spathulata H. Weim. Occasional on cliff ledges between 7,600–8,500 ft (2,316–2,591 m).. 1932

Leguminosae

Acacia sieberiana DC. var. *woodii* (Burtt Davy) Keay and Brenan. Solitary tree in Indumeni Valley at c. 5,000 ft (1,524 m)..................... —

Calpurnia intrusa E. Mey. Locally common in grassland, the Short Shrub Associes and fynbos.. 1111

Lotononis eriantha Benth. Fairly frequent in grassland on ridges of spurs between 7,200–8,100 ft (2,105–2,468 m) on Little Berg............... 1182, 1292

L. galpinii Dümmer. Occasional—fairly frequent in *Danthonia–Festuca–Pentaschistis* Grassland on summit.. 1856

L. trisegmentata Phill. var. *robusta* Phill. Occasional in grassland at c. 9,200 ft (2,804 m) near Sentinel Gate, Mont aux Sources...................... 2203

L. sp. nov. Occasional in Boulder-bed Scrub and a dwarf form on ridges of spurs of Little Berg above 7,600 ft (2,316 m).............. 1191, 1439, 1609, 1688

Buchenroedera lotononoides Scott-Elliot. Forms conspicuous communities in grassland on Little Berg and a constituent of the Short Shrub Associes and of fynbos.. 1338

Melolobium alpinum Eckl. et Zeyh. Occasional on streambanks on Little Berg 1199

M. obcordatum Harv. Several plants on rock rubble near weir in Catchment 4 1374

Argyrolobium tuberosum Eckl. et Zeyh. Occasional—frequent on streambanks on Little Berg.. 1289, 1404

A. sp. Occasional on Organ Pipes ridge above 7,400 ft (2,256 m) and on boulder-bed of rivers.......... 1183, 1906

Trifolium burchellianum Ser. Very locally common in *Themeda triandra* Grassland on Little Berg and abundant in seepage areas on summit of Drakensberg.......... 1320, 1936

Indigofera cuneifolia Eckl. et Zeyh. Fairly frequent on streambanks in Montane and Subalpine Belts.......... 998

I. hedyantha Eckl. et Zeyh. Occasional among boulders at edge of Little Berg 1275, 1335

I. longebarbata Engl. Occasional—fairly frequent in streambank communities in Montane and Subalpine Belts.......... 1325, 1433

I. woodii Bolus. Occasional on rock outcrops in grassland on Little Berg 1195, 1375

Psoralea caffra Eckl. et Zeyh. Occasional along margin of *Podocarpus latifolius* Forest and fairly frequent in *Widdringtonia dracomontana* Fynbos.......... 1001

Tephrosia macropoda (E. Mey.) Harv. Occasional—fairly frequent in grassland in Umhlonhlo Valley at 5,700 ft (1,737 m).......... 2314

T. marginella H. M. Forbes. Occasional in grassland in Masongwaan Valley 1281

T. polystachya E. Mey. var. *latifolia* Harv. Locally frequent on boulder-bed of Mlambonja Valley.......... 1903

Sutherlandia montana Phill. et Dyer. Occasional on boulder-beds of rivers.. 1605

Lessertia perennans DC. Fairly frequent in streambank communities on Little Berg.......... 1210, 1242

L. thodei L. Bol. Occasional on ridges of spurs above 7,000 ft (2,135 m) and in *Danthonia–Festuca–Pentaschistis* Grassland.......... 1299

Desmodium repandum (Vahl) DC. Rare in field layer of *Podocarpus latifolius* Forest.......... 1667

Dumasia villosa DC. Occasional along margin and in open parts of *Podocarpus latifolius* Forest.......... 1505, 1662

Rhynchosia caribaea DC. Frequent in *Miscanthidium capense* Grassland along margin of *Leucosidea sericea* Scrub on Little Berg.......... 1379

Eriosema kraussianum Meisn. Forms small socies in *Themeda triandra* Grassland in Montane and Subalpine Belts.......... 1026

Geraniaceae

Geranium caffrum Eckl. et Zeyh. Occasional in vleis in Montane Belt.......... 1780

G. incanum L. Common in moist parts of *Danthonia–Festuca–Pentaschistis* Grassland on summit.......... 1844

G. ornithopodum Eckl. et Zeyh. var. *album* Kuntze. Fairly frequent in streambank communities on Little Berg.......... 974

G. ornithopodum Eckl. et Zeyh. var. *lilacinum* Kuntze. Fairly frequent on streambanks on Little Berg.......... 1468

G. pulchrum N. E. Br. Frequent on streambanks and in vleis on Little Berg 1027

Monsonia attenuata Harv. Occasional—fairly frequent in grassland in Montane and Subalpine Belts.......... 1274, 1308

Pelargonium alchemilloides Willd. Occasional in Tall Grassland on streambanks on Little Berg.......... 1462

P. alchemilloides Willd. var. *dentatum* Harv. Occasional in *Themeda triandra* Grassland in the Montane Belt.......... 2132

P. dispar N. E. Br. Very locally abundant in Boulder-bed Scrub.......... 1432

P. luridum (Andr.) Sweet. Rare in *Themeda triandra* Grassland on Little Berg 1219, 2211

P. sp. nov. aff. *P. pulverulentum* Sw. Occasional in grassland immediately above Cave Sandstone cliffs in Indumeni Valley.......... 1787

Oxalidaceae

Oxalis obliquifolia Steud. Forms small colonies in grassland and on outcrops in Montane and Subalpine Belts, also in *Danthonia–Festuca–Pentaschistis* Grassland.......... 1077

O. sp. nr. *O. obliquifolia* Steud. Common on rock outcrops in Montane and Subalpine Belts........ —

LINACEAE

Linum thunbergii Eckl. et Zeyh. Occasional in moist parts of *Themeda triandra* Grassland on Little Berg........ 1646

RUTACEAE

Calodendrum capense Thunb. Occasional in *Podocarpus latifolius* Forest..... 1899

Clausena anisata (Willd.) Hook. f. Fairly frequent in small tree layer of *Podocarpus latifolius* Forest........ 1928

MELIACEAE

Ekebergia meyeri Presl. Very rare in *Podocarpus latifolius* Forest........ 1658

POLYGALACEAE

Polygala confusa MacOwan. Occasional in field layer of *Podocarpus latifolius* Forest........ 1620

P. gerrardii Chod. Rare on stony koppie on Little Berg........ 1578

P. hispida Burch. Occasional on streambanks on Little Berg........ 995

P. hottentota Presl. Rare in *Themeda triandra* Grassland........ 1198

P. myrtifolia L. Fairly frequent in Short Shrub Associes and dwarf form locally frequent on stony ridge of Organ Pipes spur........ 1011, 1634

P. rehmannii Chod. Occasional—fairly frequent on outcrops on Little Berg.. 1118

P. virgata Thunb. Occasional in Short Shrub Associes along margin of *Podocarpus latifolius* Forest........ 1137

Muraltia flanaganii Bol. Rare in alpine heath........ —

M. lancifolia Harv. Rare in grassland in Indumeni Valley........ 1737

M. saxicola Chod. Occasional in rock crevices on ridge of Organ Pipes spur and fairly frequent on summit........ 1587

EUPHORBIACEAE

Adenocline mercurialis Turcz. Forms small societies in field layer of *Podocarpus latifolius* Forest........ 1278

Acalypha depressinervia (Kuntze) K. Schum. Forms frequent and large socies in grassland up to 7,000 ft (2,133 m)........ 1581

A. punctata Meisn. Forms frequent and large socies in grassland up to 7,000 ft (2,133 m)........ 1224

Clutia galpinii Pax. Occasional in *Miscanthidium capense* Grassland in moist gully in Ndedema Valley........ 1611

C. katharinae Pax. Occasional—fairly frequent in streambank scrub on Little Berg........ 1005

C. monticola S. Moore. Fairly frequent in boulder crevices on koppie on Little Berg........ 1108

C. nana Prain. Occasional in *Danthonia–Festuca–Pentaschistis* Grassland on summit........ 1885

C. natalensis Bernh. Common on streambanks and moist areas on Little Berg. Constituent of fynbos........ 1051

Euphorbia clavarioides Boiss. Occasional at edge of Little Berg........ —

E. epicyparissias E. Mey. Common on streambanks and moist areas generally in Montane and Subalpine Belts........ 972

E. ericoides Lam. Occasional in *Themeda triandra* and Temperate Grassland on Little Berg........ 993

E. guenzii Boiss. Very locally frequent in *Themeda triandra* Grassland on Little Berg, Eastmans Peak area........ 1617

E. guenzii Boiss. var. *albovillosa* N. E. Br. Locally frequent in *Themeda triandra* Grassland on Little Berg, Eastmans Peak area........ 1616

Anacardiaceae

Rhus dentata Thunb. var. *puberula* Sond. A forest precursor. Fairly frequent along margin of *Podocarpus latifolius* Forest and occasional in *Leucosidea sericea* Scrub on Little Berg.......... 978

R. discolor E. Mey. Frequent in grassland on Little Berg. A constituent of *Passerina–Philippia–Widdringtonia* Fynbos.......... 1196

R. gerrardii Harv. Very rare on banks of Mlambonja River.......... 2325

R. lucida L. Fairly frequent in cliff scrub in Ndedema Valley.......... 1619

R. pyroides Burch. var. *gracilis* (Engl.) Burtt Davy. Rare on cliff ledge in Tsanatalana Valley at 8,000 ft (2,438 m).......... 1977

R. tomentosa L. Occasional along margin of *Podocarpus latifolius* Forest.. 1066

Aquifoliaceae

Ilex mitis (L.) Radlk. Occasional—fairly frequent in *Podocarpus latifolius* Forest usually near water and on streambanks on Little Berg.. 1215, 1731, 1732

Celastraceae

Maytenus acuminatus (L.f.) Loes. Occasional on streambanks on Little Berg.. 1621

M. cymosus (Soland.) Exell. Rare among boulders in Montane Belt.......... 1022

M. mossambicensis (Klotzsch) Blakelock var. *mossambicensis.* Occasional in *Podocarpus latifolius* Forest in Oqalweni Valley.......... 1898

M. peduncularis (Sond.) Loes. Fairly frequent in *Podocarpus latifolius* Forest 1671, 1757

M. undatus (Thunb.) Blake. Frequent in *Podocarpus latifolius* Forest.......... 988

Pterocelastrus galpinii Loes. Fairly frequent—common in *Podocarpus latifolius* Forest.......... 1733

P. sp. nov. Fairly frequent—common in *Podocarpus latifolius* Forest.... 1730, 2150

Cassine tetragona Loes. var. *laxa* Loes. Occasional—fairly frequent in *Podocarpus latifolius* Forest.......... 1870B, 2297

Icacinaceae

Cassinopsis ilicifolia (Hochst.) Kuntze. Occasional in shrub layer of *Podocarpus latifolius* Forest.......... 1135

Apodytes dimidiata E. Mey. Occasional in *Podocarpus latifolius* Forest...... 1734

Sapindaceae

Allophylus melanocarpus (Arn.) Radlk. Occasional in *Podocarpus latifolius* Forest.......... 1971

Melianthaceae

Melianthus villosus H. Bol. Common in moist areas in *Podocarpus latifolius* Forest Belt and in fynbos in Subalpine Belt.......... 1211, 1380

Greyia sutherlandii Hook. et Harv. Frequently co-dominant with *Cussonia paniculata* on lowermost basalt cliffs at edge of Little Berg.......... 1003

Balsaminaceae

Impatiens duthieae L. Bol. Forms small societies in very moist parts of *Podocarpus latifolius* Forest.......... —

Rhamnaceae

Scutia myrtina (Burm. f.) Kurz. Occasional in *Podocarpus latifolius* Forest... —

Rhamnus prinoides L'Herit. A forest precursor. Common along margin of *Podocarpus latifolius* Forest and on streambanks on Little Berg.......... 1064

Vitaceae

Rhoicissus revoilii Planch. Abundant in *Podocarpus latifolius* Forest...... 1736, 2146

R. cuneifolius (Eckl. et Zeyh.) Planch. Occasional on marginal trees and shrubs of *Podocarpus latifolius* Forest.......... 1511

Tiliaceae

Sparmannia ricinocarpa (Eckl. et Zeyh.) Kuntze. Rare in streambank scrub in Oqalweni Valley.......... 2361

Malvaceae

Sphaeralcea pannosa H. Bol. Locally common in fynbos in Tutumi Valley.. 2291

Pavonia columella Cavan. Rare in *Themeda triandra* Grassland in Indumeni Valley.......... 1942

Hibiscus aethiopicus L. Occasional on outcrops on Little Berg.......... 1626

H. hastaefolius E. Mey. Locally common in *Cymbopogon validus* Grassland on Little Berg.......... 1412

H. trionum L. var. *ternatus* Harv. Occasional on streambanks on Little Berg 1359

H. trionum L. var. Fairly frequent in moist depressions in grassland on Little Berg.......... 1497

Sterculiaceae

Hermannia gerrardii Harv. Occasional—fairly frequent in grassland in Masongwaan Valley.......... 1512

H. malvaefolia N. E. Br. Occasional along margin of *Leucosidea sericea* Scrub on Little Berg.......... 1722

H. woodii Schinz. Occasional in *Themeda triandra* Grassland and fairly frequent on outcrops on Little Berg.......... 1138

Ochnaceae

Ochna atropurpurea DC. Rare along margin of *Podocarpus latifolius* Forest 1816

Guttiferae

Hypericum lalandii Choisy. Common in vleis in Montane and Subalpine Belts 1173

Flacourtiaceae

Kiggelaria africana L. Frequent in *Podocarpus latifolius* Forest.......... 986, 2214

Scolopia mundtii (Eckl. et Zeyh.) Warb. Frequent in *Podocarpus latifolius* Forest.......... 1739

Trimeria grandifolia (Hochst.) Warb. Occasional—fairly frequent in *Podocarpus latifolius* Forest.......... 1507, 1863

Dovyalis zeyheri Warb. Occasional at base of small cliff in Oqalweni Valley 1901

Achariaceae

Guthriea capensis H. Bol. Occasional in grassland between 9,000–9,600 ft (2,743–2,929 m).......... 2199

Begoniaceae

Begonia sutherlandii Hook. f. Forms frequent societies in moist parts of *Podocarpus latifolius* Forest.......... 1389

Oliniaceae

Olinia emarginata Burtt Davy. A forest precursor. Frequent along margin of *Podocarpus latifolius* Forest and occasional on streambanks on Little Berg.......... 1355, 1743

Thymelaeaceae

Gnidia compacta C. H. Wright. Forms cushions on stony ridges of spurs above 7,500 ft (2,286 m) on Little Berg.......... 1187

G. polystachya Berg. var. *congesta* C. H. Wright. Frequent in heath on summit 1852

Lasiosiphon anthylloides Meisn. Rare in fynbos.......... 1825

L. caffer Meisn. Rare in *Themeda triandra* Grassland in Mhlwazeni Valley.. 1804

L. polyanthus Gilg. Locally frequent along streambank in Ndedema Valley.. 1719

L. sp. cf. *L. polyanthus* Gilg. Occasional in *Themeda triandra* Grassland on Little Berg.......... 1750

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Arthrosolen microcephalus (Meisn.) Phill. Fairly frequent in *Themeda triandra* Grassland in Mhlwazeni Valley........ 1805

Basutica aberrans (C. H. Wright) Phill. Occasional on streambanks at 9,300 ft (2,835 m)........ 1837

Passerina filiformis L. One of dominants in *Passerina–Philippia–Widdringtonia* Fynbos........ 1973, 2289

P. montana Thoday. Frequent on boulder-beds of rivers, co-dominant in Cave Sandstone Scrub, frequent on ridges of spurs on Little Berg and locally dominant in heath on summit 4,200–c. 10,000 ft (1,280–c. 3,048 m) 1011, 1585, 2289

Dais cotinifolia L. Occasional on streambanks in Montane Belt........ 1815

Onagraceae

Epilobium flavescens E. Mey. Very rare in *Themeda triandra* Grassland on Little Berg........ 1116

E. salignum Hausskn. Common in vleis in Montane and Subalpine Belts.... 1397

Oenothera laciniata A. W. Hill. Frequent in neglected garden on Little Berg 2307

O. rosea Ait. Frequent in drier parts of vleis in Montane and Subalpine Belts 1086

Halorrhagidaceae

Gunnera perpensa L. Frequent in vleis and moist areas generally in Montane and Subalpine Belts........ 1176

Araliaceae

Cussonia paniculata Eckl. et Zeyh. Occasional among boulders in grassland in Montane Belt and frequent—co-dominant with *Greyia sutherlandii* on cliffs at edge of Little Berg........ 1387

C. spicata Thunb. Occasional in *Podocarpus latifolius* Forest........ 1968

Umbelliferae

Sanicula europaea L. Locally common in field layer of *Podocarpus latifolius* Forest and *Leucosidea* Scrub on Little Berg........ 1142

Alepidea amatymbica Eckl. et Zeyh. Frequent on streambanks on Little Berg 1410

A. capensis (Berg) R. A. Dyer. Occasional—fairly frequent in Temperate Grasslands on Little Berg........ 1311

A. galpinii Dümmer. Fairly frequent in *Danthonia–Festuca–Pentaschistis* Grassland........ 2270

A. setifera N. E. Br. Occasional—frequent on streambanks and in Temperate Grassland on Little Berg........ 1349

A. thodei Dümmer. Locally frequent in *Danthonia–Festuca–Pentaschistis* Grassland........ 2335

Conium chaerophylloides Eckl. et Zeyh. Very rare in *Podocarpus latifolius* Forest 2213

Heteromorpha trifoliata Eckl. et Zeyh. Occasional in *Cymbopogon validus* Grassland outside margin of *Podocarpus latifolius* Forest........ 1890

Bupleurum mundtii Cham. et Schlecht. Occasional in grassland above 7,000 ft (2,133 m)........ 1303

Pimpinella caffra Harv. Rare in *Themeda triandra* Grassland above 6,500 ft (1,981 m) on Little Berg........ 1460, 1861

P. stadensis Harv. forma. Occasional—fairly frequent in *Pentaschistis tysonii* Grassland........ 1469

Sium repandum Welw. ex Hiern. Frequent along streams in Montane Belt 2131, 2326

Polemannia montana Schltr. et Wolff. Occasional—fairly frequent on streambanks in Montane and Subalpine Belts........ 1436, 1464

Peucedanum caffrum Phill. Occasional on basalt outcrops at edge of Little Berg 1047

P. capense Sond. Occasional in *Cymbopogon validus* Grassland outside margin of *Podocarpus latifolius* Forest........ 1891

Umbellifer (um-Phondovu). Fairly frequent on streambanks on Little Berg 1227, 1641

Umbellifer. Rare among boulders at base of cliff in Sentinel area. c. 9,000 ft (2,743 m)........ 2200

Cornaceae

Curtisia dentata (Burm. f.) C. A. Sm. Occasional in *Podocarpus latifolius* Forest.. 1900

Ericaceae

Erica aestiva Mark. Rare on boulder-bed of Tseketseke River.............. 1746

E. algida H. Bol. Occasional in grassland between 6,600–9,400 ft (2,012–2,865 m).. 1148, 1839

E. alopecurus Harv. Rare on streambanks on Little Berg and summit....... 1516

E. caffrorum H. Bol. Very rare on boulder-bed of Tseketseke River........ 1829

E. caffrorum H. Bol. var. *luxurians* H. Bol. Fairly frequent in stream gully in Mhlwazeni Valley.. 1811

E. cerinthoides L. Frequent on pavements immediately above Cave Sandstone cliffs.. 1748

E. drakensbergensis Guth. et H. Bol. Locally frequent in Cave Sandstone Scrub.. 1708, 1970

E. dykei L. Bol. Fairly frequent on rocky ridge of spur on Little Berg..... 1881

E. ebracteata H. Bol. Occasional on boulder-beds of rivers and sometimes dominant in fynbos in Subalpine Belt.............................. —

E. flanaganii H. Bol. Locally abundant in heath in Sentinel area........... 2197

E. frigida H. Bol. Frequent in rock crevices on ridge of spur above 8,700 ft (2,651 m) and on summit.................................. 1910. 1949, 1960

E. oatesii Rolfe. Occasional in grassland between 5,000–6,800 ft (1,524–2,072 m).. 1430, 1758

E. reenensis Zahl. Rare in rock crevices on ridge of spur above 8,700 ft (2,651 m) 1916

E. thodei Guth. et H. Bol. Frequent on ridge of spur leading to Organ Pipes and on basalt slabs adjacent streams on summit....................... 1480, 1937

E. westii L. Bol. Occasional in grassland in Montane Belt, fairly frequent in Cave Sandstone Scrub and abundant along margin of fynbos........ 1610, 1663

E. woodii H. Bol. Fairly frequent in grassland above 6,500 ft (1,981 m) on Little Berg.. 1376

E. sp. nov. (= Schelpe 71, 72, 847). One of dominants in *Erica–Helichrysum* Heath.. 1728

E. sp. nov. (= Schelpe 616). Locally dominant in *Erica–Helichrysum* Heath.. 1729

E. sp. Rare in *Pentaschistis tysonii* Grassland on Little Berg.............. 2189

Philippia evansii N. E. Br. Frequently subdominant in *Cliffortia linearifolia* Scrub along streams and one of dominants in fynbos on Little Berg.. 1002, 1527

Myrsinaceae

Myrsine africana L. Frequent along margin of *Podocarpus latifolius* Forest and *Leucosidea sericea* Scrub and in fynbos.............................. 973

Rapanea melanophloeos (L.) Mez. Occasional in *Podocarpus latifolius* Forest 1023

Primulaceae

Lysimachia ruhmeriana Vatke. Rare on streambanks on Little Berg......... 1180

Anagallis huttonii Harv. Locally common in vleis on Little Berg........... 1231

Ebenaceae

Diospyros austroafricana de Winter var. *austroafricana*. Occasional—fairly frequent in Short Shrub Associes and subalpine fynbos.................. 1040, 1050

D.lycioides Desf. subsp. *sericea* (Bernh.) de Winter. Very rare in grassland in Indumeni Valley.. 2137

D.whyteana (Hiern.) F. White. Commonly dominant in small tree layer of *Podocarpus latifolius* Forest.. 1509, 1647

Euclea lanceolata E. Mey. A forest precursor. Frequent along margin of *Podocarpus latifolius* Forest.. 979

Loganiaceae

Gomphostigma virgata (L.f.) Baill. Fairly frequent on boulder-beds of rivers in Montane Belt........ 1807

Buddleia auriculata Benth. var. *euryfolia* Prain. Occasional in *Podocarpus latifolius* Forest........ 1755

B. corrugata (Benth.) Phill. Locally frequent on boulder-bed of rivers and in fynbos above 7,600 ft (2,316 m)........ 2278, 2279, 2286

B. salviifolia (L.) Lam. A forest precursor. Frequently dominant or co-dominant in scrub on streambanks and sheltered areas generally in Montane and Subalpine Belts, 4,200–7,000 ft (1,280–2,133 m)........ —

Gentianaceae

Sebaea filiformis Schinz. Occasional—fairly frequent in *Themeda triandra* Grassland on Little Berg........ 1503

S. grandis (E. Mey.) Steud. Fairly frequent in grassland in Montane Belt... 2328

S. macrophylla Gilg. Locally frequent in Short Shrub Associes in Montane Belt........ 1742

S. natalensis Schinz. Rare on streambanks on Little Berg........ 1225

S. procumbens A. W. Hill. Locally frequent on vertical banks of streams on Little Berg........ 1121

S. repens Schinz. Abundant in moss mats on moist rock faces next to streams on Little Berg........ 1724

S. spathulata Steud. Very rare in grassland at 9,300 ft (2,835 m) below Sentinel 3434

S. thodeana Gilg. Common in Sedge Meadow and moist parts of *Danthonia–Festuca–Pentaschistis* Grassland on summit........ 1845

S. sp. Locally common on moist cliff face at 9,300 ft (2,835 m)........ 1917

Chironia krebsii Griseb. Locally frequent in vleis on Little Berg........ 1202

C. peglerae Prain. Rare in open, moist part of Ndedema Gorge Forest and in *Cymbopogon validus* Grassland on Little Berg........ 1643, 2293

Swertia welwitschii Engl. Locally common in vleis on Little Berg........ 1385

Apocynaceae

Carissa bispinosa (L.) Desf. Frequently dominant in shrub layer of *Podocarpus latifolius* Forest........ 1216

Asclepiadaceae

Raphionacme hirsuta (E. Mey.) R. A. Dyer. Rare—occasional in *Themeda triandra* Grassland on Little Berg........ 1078, 1599, 1601

Xysmalobium parviflorum Harv. Rare among boulders on koppies on Little Berg........ 1097

Schizoglossum atropurpureum E. Mey. Occasional in *Miscanthidium capense* Grassland in Montane and Subalpine Belts........ 1388

S. flavum Schltr. Locally frequent in *Pentaschistis tysonii* Grassland........ 1580

S. flavum Schltr. var. *lineare* N. E. Br. Occasional among boulders on koppies on Little Berg........ 1099

S. linifolium Schltr. Rare in *Themeda triandra* Grassland at 6,700 ft (2,042 m) 1206

S. montanum R. A. Dyer. Forms small socies in grassland between 7,300–9,300 ft (2,225–2,835 m) on Little Berg........ 1838, 2285

S. pulchellum Schltr. Rare—occasional in *Themeda triandra* Grassland in Montane and Subalpine Belts........ 1771, 1779

S. woodii Schltr. Very rare in grassland in Mlambonja Valley........ 1775

Pachycarpus campanulatus N. E. Br. var. *sutherlandii* N. E. Br. Very rare in *Themeda triandra* Grassland on Little Berg........ 1348

P. sp. Rare in *Themeda triandra* Grassland on Little Berg........ 1203

Asclepias affinis Schltr. Rare in *Themeda triandra* Grassland in Indumeni Valley........ 1680

A. humilis Schltr. Occasional in *Pentaschistis tysonii* Grassland........ 1633

A. reenensis N. E. Br. Occasional in *Rendlia altera* Grassland on Little Berg 1205

A. schizoglossoides Schltr. Rare in grassland on Little Berg.............. 1016, 1795

A. stellifera Schltr. Locally frequent in *Themeda triandra* Grassland on Little Berg.. 960

Secamone alpinii Schult. Rare on riverbank trees in Mhlwazeni Valley...... 1820

S. sp. (sterile material). Fairly frequent climber in *Podocarpus latifolius* Forest 1964

Sisyranthus imberbis Harv. Very rare in *Themeda triandra* Grassland in Mlambonja Valley.. 1784

Anisotoma pedunculata N. E. Br. Occasional in *Themeda triandra* Grassland at edge of Little Berg.. 1049

Riocreuxia torulosa Decne. var. *tomentosa* N. E. Br. Occasional—fairly frequent on streambank and forest margin shrubs in Montane and Subalpine Belts 1256

Tylophora flanaganii Schltr. Common climber in *Podocarpus latifolius* Forest 2143

Boraginaceae

Cynoglossum enerve Turcz. Occasional in Bracken Veld on Little Berg...... 1115

Tysonia africana H. Bol. Frequent in Tall Grassland on streambanks and in moist gullies on Little Berg.. 1360

Myosotis sylvatica Hoffm. Frequent on streambanks on Montane and Subalpine Belts.. 1037

Lithospermum afromontanum Weim. Fairly frequent on streambanks and in moist gullies on Little Berg................................ 1326, 1364, 2129

L. papillosum Thunb. Very locally common in grassland at c. 8,500 ft (2,591 m) near Sentinel Gate, Mont aux Sources.............................. 2209

Labiatae

Ajuga ophrydis Burch. Locally frequent on streambanks and in moist areas generally in Montane and Subalpine Belts............................ 1039

Teucrium capense Thunb. Rare in moist gully in Indumeni Valley.......... 1790

Leonotis dysophylla Benth. Common in *Cymbopogon validus* Grassland and *Miscanthidium capense* Grassland.................................. 1415

L. sp. probably *L. dubia* E. Mey. Not seen in flower. Rare in Ndedema Gorge Forest.. —

Stachys albiflora N. E. Br. Occasional in Short Shrub Associes in Montane Belt and on streambanks on Little Berg.......................... 1329, 1687

S. caffra E. Mey. Occasional in field layer of *Podocarpus latifolius* Forest.. 1895

S. dregeana Benth. Occasional in grassland at c. 9,300 ft (2,835 m) in Sentinel area, Mont aux Sources.. 2201

S. rugosa Ait. Frequent in *Themeda triandra* Grassland in Mokhotlong Valley 1984

S. sp. nr. *S. obtusifolia* MacOwan. Occasional in *Pentaschistis tysonii* Grassland on Little Berg.. 1286, 1630

Satureia compacta Killick. Very locally frequent in *Festuca costata* Grassland below Amphletts.. 1866

S. grandibracteata Killick. Locally frequent in *Themeda triandra* Grassland in Catchment 9 on Little Berg........................... 1102, 1600, 1684, 2123

S. reptans Killick. Frequent in moist areas at edge of scrub and forest in Montane and Subalpine Belts.. 1272, 1429

Aeolanthus canescens Guerke. Rare on Cave Sandstone outcrops........... 1924

Pycnostachys reticulata (E. Mey.) Benth. Occasional in vleis and on streambanks in Montane and Subalpine Belts.................................. 1444

Plectranthus calycinus Benth. Occasional—fairly frequent in grassland in Montane and Subalpine Belts.. 1399

P. dolichopodus Briq. Fairly frequent in field layer of *Podocarpus latifolius* Forest... 1965, 1676

P. grallatus Briq. Frequent in Short Shrub Associes in Montane Belt and on streambanks and in moist gullies on Little Berg..................... 1328, 2366

Syncolostemon macranthus (Guerke) Ashby. Common in fynbos at lower elevations on Little Berg.................................... 1074, 1223, 1251, 2122

Hemizygia sp. nr. H. *stenophylla* (Guerke) Ashby. Frequent on lowermost basalt cliffs at edge of Little Berg.................................... 1644

Becium obovatum N. E. Br. Occasional in grassland in Montane Belt....... 1776

Solanaceae

Physalis peruviana L. Occasional in field layer of *Podocarpus latifolius* Forest 1963

Solanum giganteum Jacq. Occasional on roadsides in Montane Belt....... 1707

Scrophulariaceae

Diascia stachyoides Schltr. Rare in streambank scrub in Ndedema Valley.. 1651

D. purpurea N. E. Br. Locally frequent on rock outcrops at 6,800 ft (2,073 m) in Tutumi Valley.. 2292

D. sp. nov. aff. *D. barberae* Hook. Locally frequent in grassland above 9,000 ft (2,743 m) often among boulders.................................... 1488, 1912

Nemesia cynanchifolia Benth. Occasional in *Themeda triandra* Grassland on Little Berg.. 1058

N. denticulata (Benth.) Grant. Rare in *Themeda triandra* Grassland on Little Berg.. 1175

N. melissaefolia Benth. Occasional on boulder-beds of rivers.......... 1398, 1818

N. sp. nr. *N. melissaefolia* Benth. Occasional in *Danthonia–Festuca–Pentaschistis* Grassland.. 1979

Diclis reptans Benth. Frequent in moist areas in Montane and Subalpine Belts.. 980, 1909

Halleria lucida L. Occasional—fairly frequent on streambanks, in *Podocarpus latifolius* Forest and among boulders on koppies on Little Berg........ —

Phygelius capensis E. Mey. Occasional in *Cliffortia linearifolia* Scrub on streambanks on Little Berg.. 1073

Bowkeria verticillata (Eckl. et Zeyh.) Druce. Occasional on streambanks in Montane and Subalpine Belts and dominant in one type of Boulder-bed Scrub.. 1200

Manulea thodeana Diels. Occasional—fairly frequent in grassland above 6,500 ft (1.981 m) on Little Berg.................................... 1302

Sutera breviflora Hiern. Occasional—fairly frequent in grassland above 6,500 ft (1,981 m) on Little Berg.................................... 1178

S. caerulea Hiern. Occasional in *Themeda–Danthonia* Grassland in Tsanatalana Valley at 8,000 ft (2,438 m).................................... 1978

S. dentatisepala Overkott. Rare on boulder-bed of Tseketseke River........ 1827

S. floribunda Kuntze. Frequent under Cave Sandstone overhangs........... 1738

S. pristisepala Hiern. Occasional on cliff ledges at c. 7,500 ft (2,286 m) and frequent on boulder-beds of rivers.................................... 1340

Zaluzianskya alpestris Diels. Rare in *Danthonia–Festuca–Pentaschistis* Grassland —

Z. capensis Walp. Very rare on boulder-bed of Mlambonja River.......... 1902

Z. goseloides Diels. Fairly frequent on boulder-bed of rivers............... 1593

Z. langiflora Walp. Locally abundant at base of small cliff on summit in Cleft Peak area.. 2171

Z. maritima Walp. Fairly frequent in grassland in Montane and Subalpine Belts.. 1257

Z. ovata Walp. Rare among boulders on ridge of spur leading to Organ Pipes Pass. 9,000 ft (2,743 m).................................... 1834

Z. pulvinata Killick. Frequent in *Rendlia altera* Grassland, Ridge Vegetation and *Danthonia–Festuca–Pentaschistis* Grassland....................... 1584, 2204

Mimulus gracilis R. Br. Locally frequent in moist areas on Little Berg...... 1176

Limosella capensis Thunb. var. Abundant in mud-patches on summit....... 2267

L. longiflora Kuntze. Locally abundant on hummocks in vlei on summit.... 2345

L. maior Diels. Locally abundant in stagnant water on pavements at edge of Little Berg.. 1079

Hebenstreitia comosa Hochst. Occasional in grassland on Little Berg...... 1287, 1408

H. dentata L. Rare to occasional in grassland on Little Berg............ 951, 1832

H. sutherlandii Rolfe. Occasional on streambanks and in *Leucosidea sericea* Scrub on Little Berg.. 1075, 1151

Selago flanaganii Rolfe. Locally frequent in *Festuca costata* Grassland in Tutumi Valley.. 1947

S. monticola Wood et Evans. Occasional in *Themeda triandra* Grassland on Little Berg.. 1006

S. sp. nov. Fairly frequent in grassland above 6,600 ft (2,012 m) on Little Berg 1637

Glumicalyx montanus Hiern. Fairly frequent on boulder-beds of rivers and in *Danthonia–Festuca–Pentaschistis* Grassland on summit................ 1826, 2263

Veronica anagallis-aquatica L. Common on streambanks on Little Berg...... 1367

Melasma scabrum Berg. Locally common in vleis in Montane and Subalpine Belts.. 1221, 1384

Alectra basutica (Phill.) Melch. Rare in *Cymbopogon validus* Grassland on Little Berg.. 1463

A. sessiliflora (Vahl) Kuntze. Rare on streambanks in Mlambonja Valley.. 1922

A. sp. cf. *A. indica* Wettst. Rare in moist depressions on Little Berg...... 1498

Graderia scabra Benth. Occasional in *Themeda triandra* Grassland.......... 1538

Sopubia cana Harv. Occasional—fairly frequent in *Themeda triandra* Grassland 1263

Buchnera dura Benth. Occasional in *Themeda triandra* Grassland............ 1685

Cycnium racemosum Benth. Locally common on rock outcrops and occasional on streambanks on Little Berg.. 1055

Striga elegans Benth. Very rare in grassland in Ndedema Valley............ 1649

Harveya coccinea Schltr. Occasional among streambank shrubs on Little Berg 1179

H. speciosa Bernh. Occasional in *Cymbopogon validus* Grassland on streambanks on Little Berg.. 1334

Gesneraceae

Streptocarpus gardenii Hook. Forms frequent societies in *Podocarpus latifolius* Forest.. —

S. pusillus Harv. Occasional on moist rock surfaces in *Podocarpus latifolius* Forest.. 3451

Lentibulariaceae

Utricularia livida E. Mey. Abundant in stagnant pools in vleis and on pavements at edge of Little Berg.. 1159

U. sp. Locally abundant on mud-patches in *Danthonia–Festuca–Pentaschistis* Grassland on summit.. 2267

Acanthaceae

Barleria monticola Oberm. Forms socies in moist parts of *Themeda triandra* Grassland on Little Berg.. 1813

Hypoestes triflora Roem. et Schult. Occasional—fairly frequent in field layer of *Podocarpus latifolius* Forest...................................... 1894

Isoglossa eckloniana (Nees) Lindau. Occasionally dominant in field layer in open glades in *Podocarpus latifolius* Forest.......................... 2295

Rubiaceae

Kohautia amatymbica Eckl. et Zeyh. Fairly frequent in *Themeda triandra* Grassland.. 1537

Conostomium natalense (Hochst.) Bremek. Frequent in field layer of *Podocarpus latifolius* Forest.. 2296

Burchellia bubalina (L.f.) Sims. Occasional in *Podocarpus latifolius* Forest.. 1740

Pentanisia prunelloides (Klotzsch ex Eckl. et Zeyh.) Walp. Occasional in *Themeda triandra* Grassland 1127

Pygmaeothamnus chamaedendrum (Kuntze) Robyns var. *setulosus* Robyns. Fairly frequent on outcrops in grassland on Little Berg 1094

Canthium ciliatum (Klotzsch) Kuntze. Occasional in shrub layer of *Podocarpus latifolius* Forest 1154

C. pauciflorum (Klotzsch) Kuntze. Rare in *Podocarpus latifolius* Forest 1735

Pavetta cooperi Harv. et Sond. Rare in *Podocarpus latifolius* Forest 1618

Galopina circaeoides Thunb. Occasional in field layer of *Podocarpus latifolius* Forest 1392

Anthospermum aethiopicum L. Frequent on streambanks, among boulders on koppies and in fynbos on Little Berg 971, 990

A. hedyotideum Sond. Fairly frequent in vleis and on streambanks in Montane and Subalpine Belts 1083

A. herbaceum L.f. Rare in *Cymbopogon validus* Grassland outside margin of *Podocarpus latifolius* Forest 1668

A. hispidulum E. Mey. Locally abundant in *Erica–Helichrysum* Heath in Sentinel area 2196

A. rigidum Eckl. et Zeyh. Frequent on stony koppies on Little Berg 1624

Galium rotundifolium L. Forms socies on streambanks and in *Leucosidea sericea* Scrub and *Podocarpus latifolius* Forest 1358

G. wittbergense Sond. Common on streambanks and in vleis in Montane and Subalpine Belts 1241

G. wittbergense Sond. var. *glabrum* Phill. Locally frequent among boulders on summit 2332

Valerianaceae

Valeriana capensis Thunb. Occasional—fairly frequent on streambanks in Montane and Subalpine Belts and dwarf form locally frequent in summit grassland 975, 976, 1858

Dipsaceae

Cephalaria natalensis Kuntze. Common on streambanks on Little Berg 1362

Scabiosa columbaria L. Occasional in grassland on Little Berg 1310

S. drakensbergensis B. L. Burtt. Frequent on streambanks and in moist gullies on Little Berg 1528

Cucurbitaceae

Melothria cordata (Thunb.) Cogn. Occasional in streambank grasses and shrubs 1170

Cucumis myriocarpus Naud. Rare on roadside at 5,500 ft (1,676 m) 1930

Campanulaceae

Wahlenbergia fasciculata v. Brehm. Rare in *Themeda triandra* Grassland on Little Berg 1454

W. grandiflora v. Brehm. Occasional on streambanks on Little Berg 1255

W. montana A. DC. Common on rock outcrops and in grassland between 4,500–10,000 ft (1,372–3,048 m) 1214

W. squamifolia v. Brehm. var. *tenuis* v. Brehm. Fairly frequent in *Themeda triandra* Grassland on Little Berg 1421

W. undulata DC. Common in moist areas between 6,000–9,800 ft (1,829–2,987 m) 1284, 1557

W. zeyheri Eckl. et Zeyh. Fairly frequent on streambanks on Little Berg 1456

W. sp. nov. Occasional in *Danthonia–Festuca–Pentaschistis* Grassland on summit 2334

Cyphia corylifolia Harv. Rare in *Leucosidea sericea* Scrub on streambanks on Little Berg 1361

C. elata Harv. Occasional on rock outcrops at edge of Little Berg 1245

C. rogersii S. Moore var. Locally frequent in grassland at edge of Little Berg 1648

Lobelia decipiens Sond. Frequent in vleis in Montane and Subalpine Belts.. 1350

L. filiformis Lam. var. *natalensis* (A. DC.) E. Wimm. Very locally common in *Themeda triandra* Grassland on Little Berg........................ 1409

L. flaccida (Presl.) A. DC. var. *hirsutus* (Presl.) Wimm. Fairly frequent among boulders in grassland at c. 9,000 ft (2,743 m)........................ 2266

L. flaccida (Presl.) A. DC. var. Locally frequent at edge of vleis on Little Berg 1323

L. patula L.f. Occasional—locally frequent in *Podocarpus latifolius* Forest and on streambanks on Little Berg.................................... 1259

L. preslii A. DC. Frequent among large boulders on streambank in Organ Pipes Pass area.. 1914

COMPOSITAE

Vernonia hirsuta Sch. Bip. Occasional in *Themeda triandra* Grassland on Little Berg.. 1291

V. pinifolia Less. Locally frequent in grassland in Mhlwazeni Valley........ 1821

V. sp. aff. *V. hirsuta* Sch. Bip. Occasional on basalt outcrops at edge of Little Berg.. 1048

Aster filifolius Vent. Common on boulder-beds of rivers and on outcrops at edge of Little Berg.. 1423, 1726

A. muricatus Less. var. *fascicularis* E. Mey. Rare on Cave Sandstone outcrops 1925

A. perfoliatus Oliv. Occasional on outcrops and in grassland on Little Berg 1057

A. pleiocephalus Hutch. Occasional—fairly frequent in grassland on Little Berg.. 1124, 1561

A. natalensis Harv. Fairly frequent in *Danthonia–Festuca–Pentaschistis* Grassland.. 1853

Felicia linearis N. E. Br. Locally common in *Danthonia–Festuca–Pentaschistis* Grassland in Castle Buttress area.................................. 2318

F. pinnatifida Wood et Evans. Often dominant in mud-patches in *Danthonia–Festuca–Pentaschistis* Grassland.................................. 1483

Erigeron canadensis L. A ruderal which rapidly colonizes secondary areas in the Montane Belt.. —

Nidorella polycephala DC. Abundant on streambanks and in vleis in Montane and Subalpine Belts.. 1240

Conyza gouanii Willd. Rare in vlei in Mlambonja Valley.................. 1783

C. podocephala DC. Locally frequent in moist patch of *Themeda triandra* Grassland on Little Berg.. 1318

C. ivaefolia Less. Frequent on boulder-bed of Mhlwazeni River............ 1818

Nolletia ciliaris Steetz. Locally common on roadside at 5,500 ft (1,676 m).. 1920

Chrysocoma tenuifolia Berg. Rare—occasional on boulder-beds of rivers, pavements at edge of Little Berg and in heath on summit.............. 1125

Heteromma decurrens Benth. Common on streambanks on Little Berg....... 1520

H. sp. nr. *H. simplicifolia* Wood et Evans. Frequent in grassland in Tutumi Valley.. 1948

Denekia capensis Thunb. Rare—occasional in vleis on Little Berg.......... 1588

Gnaphalium luteo-album L. Abundant in drier parts of vleis in Montane Belt 1781

G. undulatum L. Frequent in disturbed areas in Montane and Subalpine Belts 1400

Helichrysum acutatum DC. Fairly frequent in *Themeda triandra* Grassland on Little Berg.. 1120

H. adenocarpum DC. Forms small socies in grassland up to 11,000 ft (3,353 m) 1501

H. adscendens (Thunb.) Less. Occasional in *Themeda triandra* Grassland on Little Berg.. 1418

H. albirosulatum Killick. Forms frequent cushions on pavements above Cave Sandstone cliffs.. 1919

H. allioides Less. Fairly frequent in *Themeda triandra* Grassland on Little Berg.. 1378

H. alticolum H. Bol. var. *montanum* H. Bol. Common in rock crevices between 8,000–10,000 ft (2,438–3,048 m).................................. 1492

H. argentissimum J. M. Wood. Forms fairly extensive socies in *Danthonia–Festuca–Pentaschistis* Grassland on summit 2173

H. aureonitens Sch. Bip. Forms very dense socies in moist parts of *Themeda triandra* Grassland 968

H. caespititium Sond. Occasional in grassland in Montane and Subalpine Belts 1060

H. coactum M. D. Henderson. Locally common in vleis on Little Berg..... 1354

H. confertum N. E. Br. Frequent on rock faces at c. 9,000 ft (2,743 m).... 2356

H. cooperi Harv. Common in moist areas on Little Berg, often in Bracken Veld 1451

H. drakensbergense Killick. Locally frequent in grassland at c. 9,200 ft (2,804 m) 1879

H. flanaganii H. Bol. Frequent in *Danthonia–Festuca–Pentaschistis* Grassland 1874

H. fulgidum (L.) Willd. Occasional in grassland on Little Berg.......... 1543, 1991

H. fulvum N. E. Br. Occasional—frequent on streambanks on Little Berg.. 1076, 1564

H. glomeratum Klatt. Fairly frequent in *Themeda triandra* Grassland in Montane and Subalpine Belts 1493

H. grandibracteatum M. D. Henderson. Common on outcrops above 6,500 ft (1,981 m) on Little Berg 1149

H. hypoleucum Harv. Occasional—fairly frequent on streambanks on Little Berg 1411

H. inerme Moeser. Locally abundant on streambanks on Little Berg........ 1457

H. infaustum Wood et Evans. Frequent at c. 8,500 ft (2,591 m) on ridge of spur leading to Organ Pipes Pass 1475

H. latifolium Less. Occasional in *Themeda triandra* Grassland in Montane and Subalpine Belts 989

H. milfordiae Killick. Forms frequent cushions on rock faces between 9,600–11,000 ft (2,926–3353 m) 1990, 2322, 2333

H. mundtii Harv. Common on streambanks and in vleis on Little Berg.... 1494

H. nanum Klatt. Forms mats on Cave Sandstone pavements.............. 1931

H. odoratissimum (L.) Less. Forms conspicuous socies in *Danthonia–Festuca–Pentaschistis* Grassland 1704

H. oreophilum Klatt. Forms small socies in grassland in Montane and Subalpine Belts 1786

H. pagophilum M. D. Henderson. Forms frequent cushions on vertical rock faces on summit 2177

H. randii S. Moore. Abundant on Cave Sandstone pavements and among boulders on koppies on Little Berg 1098, 1918

H. retortoides N. E. Br. Common among boulders at c. 9,500 ft (2,896 m) on outcrops on summit 1841, 1940

H. scapiforme Moeser. Fairly frequent in *Festuca costata* Grassland on Little Berg 969

H. scopulosum M. D. Henderson. Fairly frequent on cliffs between 7,400–9,000 ft (2,256–2,743 m) 1554, 1830, 1886

H. sessile DC. Fairly frequent in rock crevices between 8,400–9,400 ft (2,560–2,865 m) 1753

H. setigerum H. Bol. Occasional—fairly frequent in rock crevices between 8,400–10,000 ft (2,560–3,048 m) 1635

H. setosum Harv. Common in moist areas in Montane and Subalpine Belts 1336

H. splendidum Less. Rare on boulder-beds of rivers...................... 1592

H. splendidum Less. var. *montanum* Harv. Fairly frequent on cliffs between 7,600–9,400 ft (2,316–2,865 m) 1911

H. squamosum Thunb. Fairly frequent in grasslands in Montane and Subalpine Belts 1339

H. subglomeratum Less. Forms large socies in *Danthonia–Festuca–Pentaschistis* Grassland 1959

H. sutherlandii Harv. Frequent in rock crevices on koppies on Little Berg and on cliffs up to 8,000 ft (2,438 m) 1521

H. tenax M. D. Henderson. Common in disturbed, stony areas and occasional on streambanks in Montane Belt and fairly frequent in fynbos in Subalpine Belt........ 1632

H. tenuifolium Killick. Occasional—locally dominant on boulder-beds of rivers........ 1438, 1591, 2287

H. trilineatum DC. Occasional on boulder-beds of rivers and common to locally dominant in *Erica–Helichrysum* Heath........ 1604

H. trilineatum DC. var. *tomentosum* Harv. One of dominants in *Erica–Helichrysum* Heath........ —

H. umbraculigerum Less. Frequent in Tall Grassland on Little Berg...... 1452, 1590

H. sp. aff. *H. umbraculigerum* Less. Common in open parts of *Cliffortia linearifolia* Scrub on Little Berg........ 1420

Leontonyx coloratus Cass. Forms small socies in grassland on Little Berg.. 1417

Stoebe vulgaris Levyns. Occasional along margin of *Cliffortia linearifolia* Scrub and fairly frequent in Subalpine fynbos........ 1197

Metalasia muricata (L.) Less. Occasional in vicinity of Cave Sandstone cliffs 1710

Nestlera virgata N. E. Br. Occasional on streambank in Ndedema Valley.... 1720

Macowania corymbosa M. D. Henderson. Occasional in Boulder-bed Scrub and fairly frequent in fynbos........ 1681

Athrixia angustissima DC. Fairly frequent in moist parts of grassland between 6,500–10,000 ft (1,981–3,048 m)........ 1285, 2331

A. arachnoidea Wood et Evans. Locally frequent in *Themeda triandra* Grassland in upper Indumeni Valley........ 1749

A. asteroides H. Bol. et Schinz. Occasional—common in *Miscanthidium capense* Grassland on Little Berg........ 1628, 1860, 1868

A. fontana MacOwan. Common at edge of streams on Little Berg and in seepage areas on summit........ 1253, 1877

A. fontana MacOwan var. Frequent in moist rock crevices on cliff at c. 8,500 ft (2,591 m)........ 1698

A. phylicoides DC. Rare in *Hyparrhenia* Grassland in Masongwaan Valley.. 1751

A. pinifolia N. E. Br. Frequent in moist crevices in cave in Ndedema Valley 1595

Printzia pyrifolia Less. Occasional in Short Shrub Associes and on streambanks on Little Berg........ 1718

Bojeria nutans H. Bol. Very locally common in grassland above 9,300 ft (2,335 m)........ 1913

Callilepis laureola DC. Fairly frequent in grassland in Montane Belt and rare at edge of Little Berg........ 1772

Eumorphia sericea Wood et Evans. Fairly frequent in *Danthonia–Festuca–Pentaschistis* Grassland and co-dominant in Boulder-field Heath........ 1873

Athanasia punctata Harv. Common on streambanks and in fynbos on Little Berg........ 1502

A. thodei H. Bol. Co-dominant in Boulder-field Heath........ 1703

Cotula tenella E. Mey. Associated with *Aira caryophyllea* in moss mats at base of cliff at c. 9,000 ft (2,743 m)........ 1477

Cenia hispida Benth. et Hook. f. Forms small colonies among boulders at c. 8,500 ft (2,591 m)........ 1474, 1489

Schistostephium crataegifolium Fenzl. Frequent on streambanks in Montane and Subalpine Belts........ 1453

Artemisia afra Jacq. Frequent on streambanks in Montane and Subalpine Belts........ 1519

Gymnopentzia bifurcata Benth. Rare in *Danthonia–Festuca–Pentaschistis* Grassland........ 1933

G. pilifera N. E. Br. Occasional—fairly frequent in Boulder-bed Scrub...... 1725

Pentzia cooperi Harv. Frequent in *Themeda–Danthonia* Grassland in Tsanatalana Valley c. 8,000 ft (2,438 m)........ 1696, 1976

P. pinnatifida Oliv. var. *chenoloides* Hutch. Rare in grassland at 9,000 ft (2,743 m)........ 1705

Cineraria geranifolia DC. forma. Occasional along margin of *Leucosidea sericea* Scrub on Little Berg........ 1427

C. lobata L'Her. var. Fairly frequent in *Leucosidea sericea* Scrub on Little Berg........ 1426

C. lyrata DC. Occasional in *Themeda triandra* Grassland on Little Berg.... 1889

Senecio achilleaefolius DC. Common on streambanks on summit........ 1702

S. barbatus DC. Common in *Pentaschistis tysonii* Grassland........ 1150

S. barbellatus DC. Frequent in *Danthonia–Festuca–Pentaschistis* Grassland.... 1878

S. brevidentatus M. D. Henderson. Fairly frequent in vlei in Catchment 1 on Little Berg........ 1152

S. bupleuroides DC. Frequent in grassland on Little Berg........ 1038

S. caudatus DC. Occasional—frequent in *Themeda triandra* Grassland on Little Berg........ 1110, 1555

S. cryptolanatus Killick. Forms small colonies on streambanks on summit.. 1941, 2188

S. deltoideus Less. Occasional—fairly frequent along margin of *Podocarpus latifolius* Forest........ 1510

S. dregeanus DC. var. *discoideus* Harv. Rare on outcrops on Little Berg.... 1119

S. erubescens Ait. Frequent among small stones in shallow water at edge of Little Berg........ 1035

S. gramineus Harv. Frequent in *Danthonia–Festuca–Pentaschistis* Grassland.. 2180

S. haygarthii M. R. F. Taylor. Locally common on streambanks and in fynbos on Little Berg........ 992, 1571

S. hieracioides DC. Frequent in grassland at foot of cliffs at 7,500 ft (2,286 m) 1695

S. harveyanus MacOwan. Frequent in moist depressions in grassland on Little Berg........ 1496

S. inaequidens DC. Fairly frequent on cliff ledges at 7,600 ft (2,316 m)..... 1345

S. inornatus DC. Frequent on streambanks and boulder-beds of rivers in Montane and Subalpine Belts........ 1401, 1459, 1907

S. isatideus DC. Frequent in Bracken Veld on Little Berg........ 1381

S. macroalatus M. D. Henderson. Locally abundant in grassland in Organ Pipes Pass........ 1486

S. macrocephalus DC. Occasional in *Themeda triandra* Grassland on Little Berg........ 966

S. macrospermus DC. Fairly frequent in grassland at 9,000 ft (2,743 m).... 2338

S. oxyriaefolius DC. Occasional—fairly frequent on outcrops on Little Berg 1582

S. praeteritus Killick. Common in *Pentaschistis tysonii* Grassland........ 1796

S. serratuloides DC. Locally abundant in vleis on Little Berg........ 1500

S. tamoides DC. Occasional in *Podocarpus latifolius* Forest........ 1513

S. tugelensis Wood et Evans. Occasional—fairly frequent in *Danthonia–Festuca–Pentaschistis* Grassland........ 1485

S. sp. aff. *S. erubescens* Ait. Occasional in *Themeda triandra* Grassland on Little Berg........ 1059

S. sp. nr. *S. hieracioides* DC. Occasional in *Pentaschistis tysonii* Grassland.. 1823

S. sp. (= Galpin 9511). Very rare on roadside in Catchment 1........ 1243

Euryops acraeus M. D. Henderson. Occasional in *Erica–Helichrysum* Heath.. 2176

E. evansii Schltr. Forms large socies in *Danthonia–Festuca–Pentaschistis* Grassland........ —

E. laxus (Harv.) Burtt Davy. Frequent among boulders on koppies on Little Berg........ 1577

E. montanus Schltr. Occasional on streambanks on summit of Drakensberg.. 1699

E. pedunculatus N. E. Br. Occasional—fairly frequent in grassland between 6,500–9,000 ft (1,981–2,743 m)........ 1406

E. tysonii Phill. Frequent in Boulder-bed Scrub........ 1865

Othonna natalensis Sch. Bip. Very rare in *Rendlia altera* Grassland at c. 7,000 ft (2,133 m)........ 1590

Osteospermum juncundum (Phill.) T. Norl. Occasional—locally frequent in moist areas at c. 7,500 ft (2,286 m) on Little Berg 1553

O. thodei Mark. Frequent on cliffs and ridges of spurs on Little Berg between 7,500–8,700 ft (2,286–2,651 m) 1471

Chrysanthemoides monilifera (L.) T. Norl. Occasional in stony areas at edge of Little Berg 1021

Ursinia alpina N. E. Br. Forms colonies in moist places on Little Berg 1425

U. apiculata DC. Forms small colonies among boulders at c. 8,500 ft (2,591 m) 1473

U. montana DC. Frequent on outcrops on summit 1939

U. tenuiloba DC. Rare on roadside on Little Berg 1562

Haplocarpha scaposa Harv. Forms frequent socies in grassland in Montane and Subalpine Belts 1226

H. sp. aff. *H. rueppellii* (Sch. Bip.) Beauv. Frequently dominant in seepage areas on summit 2178, 2193, 2194

Hirpicium armerioides (DC.) Roessler. Fairly frequent in *Danthonia–Festuca–Pentaschistis* Grassland 1484

Gazania krebsiana Less. subsp. *krebsiana.* Occasional in *Rendlia altera* Grassland and on cliffs at c. 7,300 ft (2,225 m) 1550, 1594

Berkheya draco Roessler. Locally frequent in moist gullies and grassland at c. 7,000 ft (2,133 m) 1824

B. macrocephala J. M. Wood. Fairly frequent on streambanks and in fynbos 1556

B. multijuga (DC.) Roessler. Common on streambanks and moist rock faces in Subalpine and Alpine Belts 1422

B. rhapontica (DC.) Hutch. et Burtt Davy subsp. *aristosa* (DC.) Roessler var. *exalata* Roessler. Occasional—fairly frequent in grassland above 7,000 ft (2,133 m) 1295

B.rhapontica (DC.) Hutch. et Burtt Davy, intermediate between subsp. *aristosa* (DC.) Roessler and subsp. *platyptera* (Harv.) Roessler. Locally common on streambanks on Little Berg 1447

B. montana Wood et Evans. Frequent in *Leucosidea sericea* Scrub on Little Berg 1706

B. rosulata Roessler. Occasional—fairly frequent on cliffs between 7,000–8,500 ft (2,438–2,591 m) 2208

B. speciosa O. Hoffm. Fairly frequent on streambanks on Little Berg 1194

Cirsium vulgare (Savi.) Airy Shaw. Locally common in shallow moist depressions on Little Berg 1495

Dicoma anomala Sond. Occasional—fairly frequent in *Themeda triandra* Grassland usually at edge of Little Berg 1515

Gerbera natalensis Sch. Bip. Locally frequent in debris on side of road in Catchment 1 1010

G. piloselloides (L.) Cass. Fairly frequent on stony koppies on Little Berg.. 1721

Lactuca capensis Thunb. Occasional in vleis on Little Berg 1697

Hieracium capense L. Fairly frequent in vleis on Little Berg 1563

ABSTRACT

The factors of the environment, namely the topography, geology, soils and climate, are discussed in detail. The history of the area from pre-Shakan times is outlined. The vegetation is divided into three altitudinal belts coinciding with the three main topographical features of the area, viz. the river valley system, the Little Berg and the summit plateau of the Drakensberg. The belts are: the Montane Belt (4,200–6,000 ft, 1,280–1,829 m) with *Podocarpus latifolius* Forest as the climax community; the Subalpine Belt (6,000–9,400 ft, 1,829–2,865 m) with *Passerina–Philippia–Widdringtonia* Fynbos as climax; and the Alpine Belt (9,400–c. 11,000 ft, 2,865–c. 3,353 m) with *Erica–Helichrysum* Heath as climax. The plant communities of these belts are described in their probable successional sequence. Quantitative analyses are made of *Podocarpus latifolius* Forest and *Themeda triandra* Grassland. The literature dealing with the Drakensberg vegetation is reviewed and the biotic factors are discussed. The importance of the fire factor in retarding plant succession is emphasized. Finally, the flora is analysed and it is shown that the Drakensberg flora falls within Phillips's (1917) Eastern Mountain Region; that the flora becomes more temperate with increase in altitude; and that there are definite affinities between the flora of the Drakensberg and the floras of the Cape and tropical African mountain centres. A check-list of 916 species is included. The work is illustrated by 49 plates and one map.

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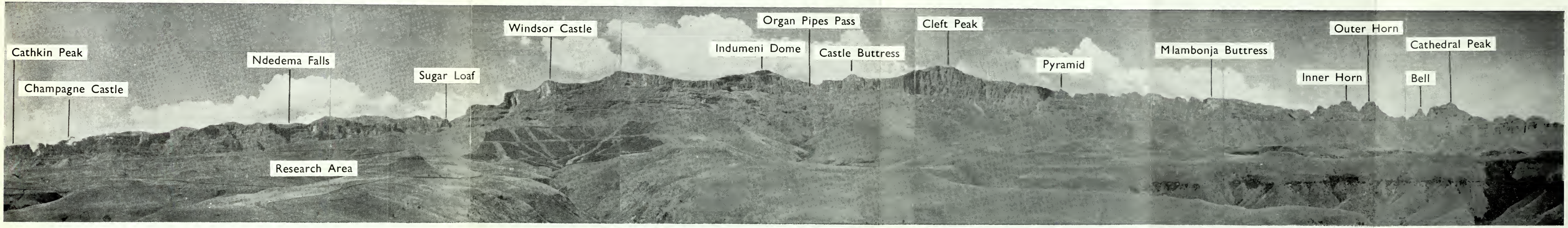


Plate 1.—A panoramic view of 12 miles (19·3 Km) of the Drakensberg Range from Cathkin Peak to Cathedral Peak.

PLATE 2.—Portion of the Little Berg between Tryme and Xaxavite. Note the predominance of grassland. Photograph taken from the summit.

PLATE 3.—Crescent-shaped terracettes in the Tutumi Valley.

PLATE 4.—*Festuca costata* Grassland after fire showing the terraced nature of a typical slope on the Little Berg.

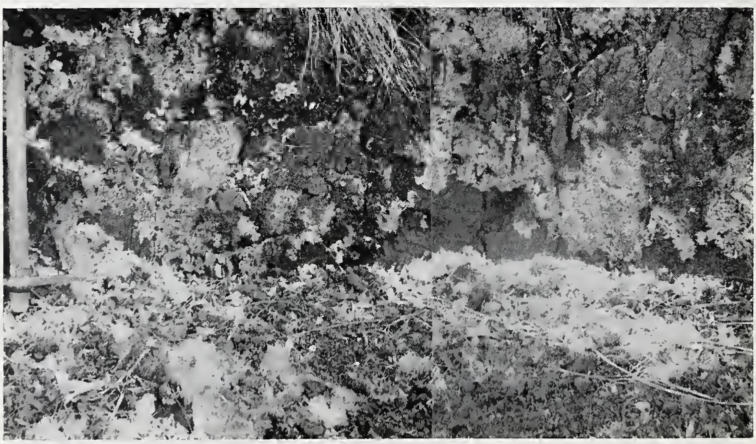


PLATE 5.—Frost crystal formation on the wall and floor of a terracette.

PLATE 6.—Snow partially covering alpine vegetation in winter. Note the cavities described on p. 18.

PLATE 7.—Boulder-bed Scrub in the Ndedema River Valley. *Leucosidea sericea* is the dominant. In the coarse sand between the boulders are *Aristida monticola*, *Aster filifolius*, *Helichrysum tenuifolium* and *Lotononis* sp. (1191).

PLATE 8.—*Protea* Savanna in the Umhlonhlo Valley.

Plate 9.—The upper reaches of the Masongwaan River Valley. On the south-east facing slopes lying between 5,500–6,100 ft (1,676–1,859 m) the succession from grassland to forest (right to left), via the *Widdringtonia dracomontana* Consocies, *Leucosidea sericea* Scrub and the Forest Precursor Associes, is very strikingly illustrated.

PLATE 10.—Mats of *Crinipes gynoglossa* and to a lesser extent *Vellozia viscosa* on the Cave Sandstone cliffs in the Indumeni Valley. The shrub at left is *Bowkeria verticillata* and in the background are *Protea* trees.

PLATE 11.—*Crinipes gynoglossa* showing tunic formation. Note the burnt leaves of the previous season.

Plate 12.—Cave Sandstone Scrub. The dominants here are *Protea roupelliae*, *Myrica pilulifera* var. *puberula* and *Cliffortia linearifolia*. The grass cover is provided mainly by *Trachypogon spicatus*, *Alloteropsis semialata*, *Ischaemum franksiae*, *Eulalia villosa* and *Elyonurus argenteus*.

Plate 13.—The lowermost basalt cliffs in the Ofandweni Valley supporting very stunted and shrubby *Podocarpus latifolius*. Below the cliffs are *Protea multibracteata*, *P. roupelliae* and a solitary *Greyia sutherlandii*.

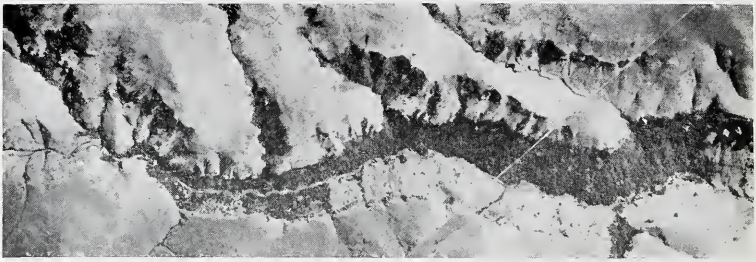


PLATE 14.—The Ndedema Gorge Forest, probably the largest patch of *Podocarpus latifolius* Forest in the Cathedral Peak area. This forest is 2 miles (3·2 Km) long.

PLATE 15.—The Masongwaan Forest on south east-facing slopes at the head of the Masongwaan Valley. Opposite is *Protea* Savanna and in the kloofs in the background are patches of *Leucosidea–Buddleia* Scrub and the Forest Precursor Associes.

Plate 16.—Interior of *Podocarpus latifolius* Forest. *Podocarpus latifolius* at left with *Diospyros whyteana* dominant in the small tree layer. The ferns present are *Pteris quadriaurita* and *Polystichum* sp. cf. *P. setiferum.*

PLATE 17.—The Indumeni Forest bordered by the Cave Sandstone cliffs of the Little Berg.

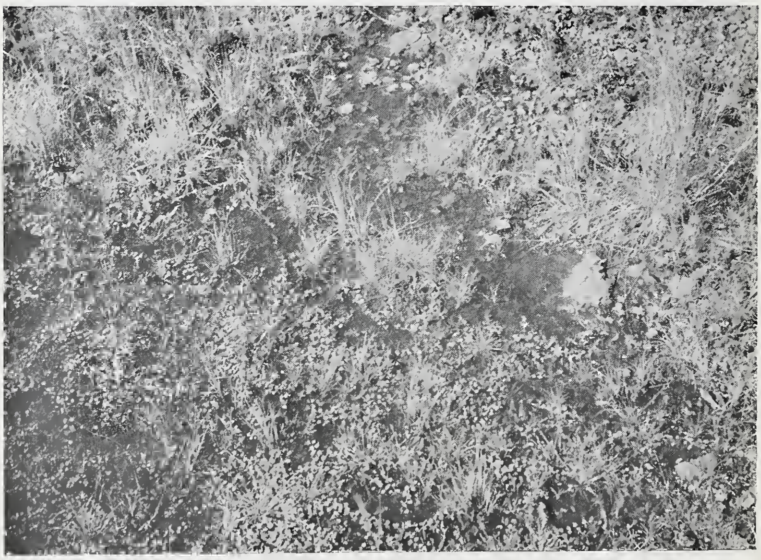


PLATE 18.—An outcrop pool in Catchment 1. The creeping herb with opposite leaves is *Anagallis huttonii* and associated with it are *Xyris capensis* and *Rhynchospora brownii*. The dry part of the outcrop at top right supports *Aristida galpinii*.

PLATE 19.—*Danthonia macowanii* Consocies fringing a stream channel on the Little Berg. Note the tussock structure of the grass. Also present are *Anemone fanninii*, *Berkheya speciosa* and *Buddleia salviifolia*.

PLATE 20.—*Cliffortia linearifolia* Scrub in Catchment 4 invaded by *Leucosidea sericea*. In the foreground are *Athanasia punctata* (large heads), *Philippia evansii* and *Cymbopogon validus*, at right are *Leucosidea sericea*, *Protea multibracteata* and *Rhus dentata* var. *puberula*, and further upstream is *Cyathea dregei*.

PLATE 21.—*Leucosidea sericea* Scrub in the Tutumi Valley at 6,500 ft (1,981 m). The grassland is mainly *Themeda triandra* Grassland with *Festuca costata* Grassland in the foreground. Other communities present are Bracken Veld surrounding the patch of *Leucosidea sericea* Scrub at the right, *Protea* Savanna and small patches of the silver-grey *Helichrysum aureonitens* on the spur in the centre.

PLATE 22.—Waterfall Vegetation. In the foreground is *Cymbopogon validus* Grassland, to the left of the waterfall in the photograph is *Scilla natalensis* and to the right is the round-leaved *Ranunculus cooperi*. Immediately above the waterfall is Umbellifer (1227).

PLATE 23.—The *Crinipes gynoglossa* Consocies showing up as white patches in *Themeda triandra* Grassland during winter.

PLATE 24.—*Rendlia altera* Grassland at 7,400 ft (2,256 m). The white-flowered geophyte is *Rhodohypoxis baurii* forma *platypetala*. Note the litter of small stones.

PLATE 25.—A terracette in Catchment 4 supporting *Monocymbium ceresiiforme* (in flower).

PLATE 26.—*Festuca costata* Grassland on a south-facing slope behind Catchment 1. December, 1953.

PLATE 27.—Ridge Vegetation at 8,700 ft (2,652 m). Present on the ridge are *Passerina montana* and *Erica thodei* accompanied by *Erica algida*, *Helichrysum argentissimum*, *H. alticolum* var. *montanum*, *Buchenroedera lotononoides*, *Rhodohypoxis baurii*, *Psammotropha mucronata*, *Senecio bupleuroides*, *Danthonia stereophylla*, *Harpechloa falx* and *Pentaschistis oreodoxa*. On the slopes of the main escarpment in the background are outcrops supporting *Vellozia viscosa*.

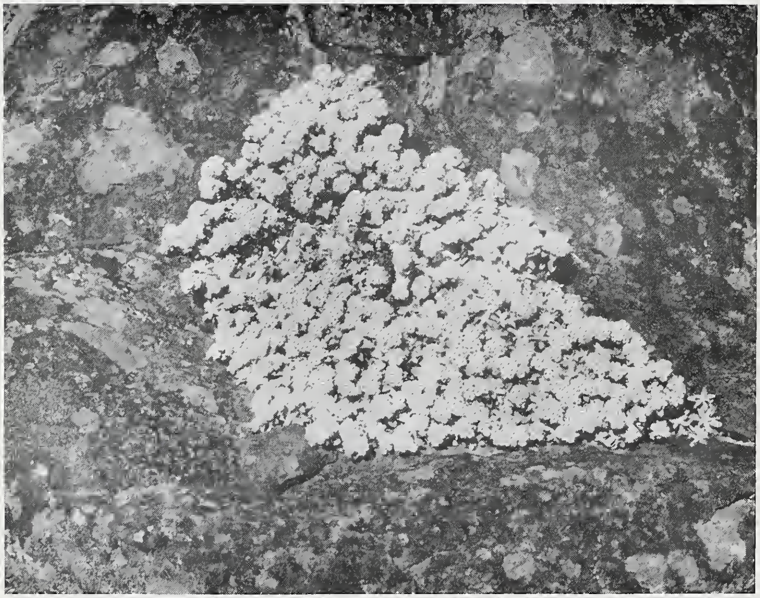


PLATE 28.—The cushion-forming *Helichrysum confertum* growing in a crevice on a cliff ledge at 9,000 ft (2,743 m).

PLATE 29.—Fynbos on escarpment slopes below the Eastern Buttress in the Tugela Valley (north of the Cathedral Peak area). *Podocarpus latifolius* Forest can be seen below the Cave Sandstone cliffs at bottom left. This photograph takes in a vertical distance of nearly 5,000 ft (1,524 m).

PLATE 30.—Mixed Fynbos at 6,800 ft (2,073 m) in the Tseketseke Valley. The constituents are *Macowania conferta*, *Encephalartos ghellinckii*, *Widdringtonia dracomontana*, *Royena hirsuta*, *Rhus dentata*, *Syncolostemon macranthus*, *Polemannia montana*, *Anemone fanninii*, *Cymbopogon validus*, *Berkheya macrocephala* and *Polystichum* sp. (981).

Plate 31.—*Passerina filiformis* Consociation in the upper Indumeni Valley. Associates present are *Helichrysum tenax*, *Athanasia punctata*, *Buddleia corrugata*, *Senecio haygarthii* and *Berkheya draco*. The herb layer consists of *Cymbopogon validus*, *Pentaschistis piloso-gluma* and *Berkheya macrocephala*. The outcrops in the background support *Vellozia viscosa*, *Cymbopogon validus*, *Scilla natalensis*, *Bucheuroedera lotononoides* and *Helichrysum sutherlandii*.

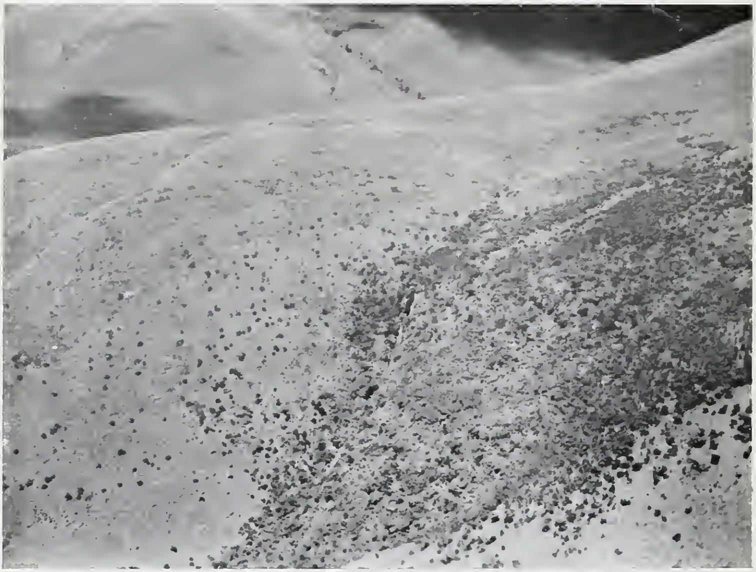


Plate 32.—*Philippia evansii* invading *Pentaschistis tysonii* Grassland and *Cymbopogon validus* Grassland in the Tutumi Valley.

Plate 33.—*Protea dracomontana* Fynbos in *Festuca–Pentaschistis* Grassland in the Tutumi Valley. In the foreground is *Buchenroedera lotononoides*.

PLATE 34.—Fairly dense *Buchenroedera lotononoides* Fynbos in the Ndedema Valley.

PLATE 35.—Alpine vegetation on the summit of the Drakensberg. In the foreground is *Erica–Helichrysum* Heath and on the slopes in the background is *Danthonia–Festuca–Pentaschistis* Grassland. Photograph taken from Cleft Peak looking northwards towards Mont aux Sources area.

PLATE 36.—*Haplocarpha* sp. (2178) Consocies in a seepage area on the summit of the Drakensberg. Associates are *Scirpus fluitans, Agrostis huttoniae* and *Berkheya multijuga* at top left. The matrix of the community is formed by mosses.

Plate 37.—A permanent pool in the Tsanatalana Valley. In the centre is the white-flowered aquatic *Aponogeton spathaceum* var. *junceum* and at the periphery are *Kniphofia caulescens* and alpine grasses.

Plate 38.—*Felicia pinnatifida* in a mud-patch in grassland at 9,800 ft (2,987 m).

PLATE 39.—Alpine Sedge Meadow Associes. The dominants are *Carex monotropa* and *C. killickii*, and associated with them are *Sebaea thodeana* (in flower), *Helichrysum subglomeratum* and *Danthonia disticha*. In the mud-patch at top right is *Rhodohypoxis rubella*.

PLATE 40.—Raised hummocks in the Langalibalele Pass area. In the foreground is *Scirpus ficinioides.*

Plate 41.—*Moraea spathulata* Socies below Indumeni Dome.

Plate 42.—Cleft Peak under snow. The plant protruding through the snow is *Euryops evansii.*

PLATE 43.—*Euryops evansii* Socies in the Tsanatalana Valley.

PLATE 44.—*Erica–Helichrysum* Association near the summit of Cleft Peak. In the centre is a patch of the grass, *Danthonia stereophylla*.

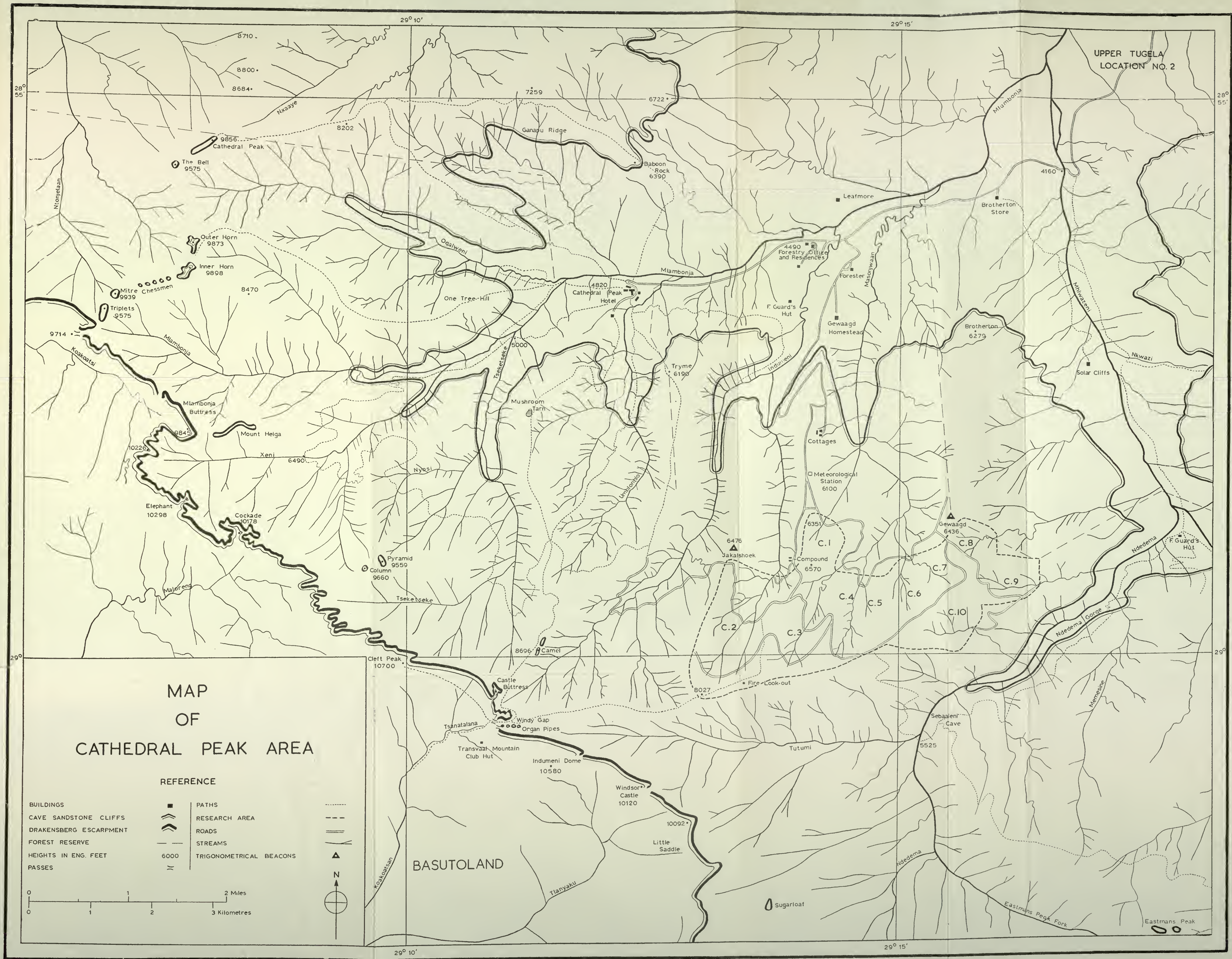
PLATE 45.—*Helichrysum–Passerina* Association situated at the edge of the escarpment near Castle Buttress.

PLATE 46.—Boulder-field Heath at 9,600 ft (2,926 m) in the Tsanatalana Valley. The grass on the streambank is *Danthonia drakensbergensis*.

Plate 47.—A Bantu hut in the Mhlwazeni Valley. Note the structure of the net placed over the thatch.

Plate 48.—A palisade surrounding a group of Bantu huts in the Mhlwazeni Valley.

PLATE 49.—Domestic articles made by the Bantu: sleeping mat, basin, maize basket and beer sieve.


MAP
OF
CATHEDRAL PEAK AREA
REFERENCE
BUILDINGS
CAVE SANDSTONE CLIFFS
DRAKENSBERG ESCARPMENT
FOREST RESERVE
HEIGHTS IN ENG. FEET
6000
PASSES
PATHS
RESEARCH AREA
ROADS
STREAMS
TRIGONOMETRICAL BEACONS
0
1
2 Miles
0
1
2
3 Kilometres
N
29° 10'
29° 15'
28° 55'
29°
UPPER TUGELA
LOCATION NO. 2
BASUTOLAND
8710
8800
8684
7259
6722
Nxaaye
8202
Ganapu Ridge
9856
Cathedral Peak
The Bell
9575
Baboon
Rock
6390
Ntonjelaan
Oqalweni
Outer Horn
9873
Inner Horn
9898
Mitre
9939
Chessmen
8470
Triplets
9575
One Tree Hill
4820
Cathedral Peak
Hotel
Mlambonja
9714
Koakoatsi
Mlambonja
Tseketseke
5000
Mlambonja
Buttress
9845
Mount Heiga
10226
Xeni
6490
Mushroom
Tarn
Nyosi
Umhlonhlo
Tryme
6190
Indumeni
Leafmore
4490
Forestry Office
and Residences
Forester
Masoniwaan
F. Guard's
Hut
Gewaagd
Homestead
Mlumbonja
4160
Brotherton
Store
Mhlwazeni
Brotherton
6279
Nkwazi
Solar Cliffs
Cottages
Meteorological
Station
6100
Elephant
10298
Cockade
10178
Pyramid
9559
Column
9660
Malorena
Tseketseke
6351
C.1
6476
Jakalshoek
Compound
6570
Gewaagd
6436
C.8
C.7
C.9
C.2
C.3
C.4
C.5
C.6
C.10
Ndedema
F. Guard's
Hut
Ndedema Gorge
8696
Camel
Cleft Peak
10700
Castle
Buttress
8027
Fire Look-out
Tsanatalana
Windy Gap
Organ Pipes
Transvaal Mountain
Club Hut
Indumeni Dome
10580
Tutumi
Sebaaleni
Cave
5525
Memesine
Windsor
Castle
10120
10092
Little
Saddle
Koakoatsan
Tlanyaku
Sugarloaf
Ndedema
Eastmans Peak Fork
Eastmans Peak

3063027